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POLLUTION OF THE INTERSTATE WATERS OF THE COLORADO RIVER AND ITS TRIBUTARIES. SESSION (1st) HELD AT PHOENIX, ARIZONA ON JANUARY 13, 1960, SESSION (2nd) HELD AT LAS VEGAS, NEVADA ON MAY 11, 1961, AND SESSION (3rd), HELD AT SALT LAKE CITY, UTAH ON MAY 9-10, 1962. TRANSCRIPT OF CONFERENCE

Public Health Service
Washington, D. C.

1962

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TRANSCRIPT OF CONFERENCE ON

Pollution of the Interstate Waters of the Colorado River and its Tributaries

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ARIZONA - NEVADA - UTAH

THREE SESSIONS

PHOENIX, ARIZONA - JANUARY 13, 1960
LAS VEGAS, NEVADA - MAY 11, 1961
SALT LAKE CITY, UTAH - MAY 9-10, 1962

TRANSCRIPT OF CONFERENCE

Conference on Pollution of the Interstate Waters
of the
Colorado River and its Tributaries, First Session

Called by the Surgeon General, Public Health Service,
Under Section 8 of Public Law 84-660

The Public Health Service, U. S. Dept. of Health, Education, and Welfare,
And the State Water Pollution Control Agencies of
Arizona - California - Colorado - Nevada -
New Mexico - Utah - Wyoming

Phoenix, Arizona . . . . January 13, 1960

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Conference on Pollution of the Interstate Waters of the Colorado River and its Tributaries, First Session

Phoenix Library Auditorium
12 McDowell Road
Phoenix, Arizona
January 13, 1960

Chairman: Mr. Murray Stein
Chief, Enforcement Branch
Division of Water Supply and Pollution Control
U. S. Public Health Service
Washington, D. C.

Conferees: Mr. Kaarlo W. Nasi
Regional Program Director, Region VIII
Division of Water Supply and Pollution Control
U. S. Public Health Service
Denver, Colorado

Charles G. Salsbury, M. D.
Commissioner of Public Health
State Department of Health
Phoenix, Arizona

Mr. George W. Marx
Director, Division of Sanitary Engineering
State Department of Health
Phoenix, Arizona

Mr. Paul R. Bonderson, Executive Director
California State Water Pollution Control Board
Sacramento, California

Roy L. Cleere, M. D.
Executive Director
Colorado State Department of Public Health
Denver, Colorado

Mr. William N. Gahr
Director, Division of Sanitation
Colorado State Department of Public Health
Denver, Colorado

Daniel J. Hurley, M. D.
Acting State Health Officer
Nevada State Department of Health
Carson City, Nevada

Conferees: (Continued)

Stanley J. Leland, M. D.
State Director of Public Health
New Mexico Department of Public Health
Santa Fe, New Mexico

Mr. Charles G. Caldwell
Director, Environmental Sanitation Services
New Mexico Department of Public Health
Santa Fe, New Mexico

Mr. Lynn M. Thatcher, Executive Secretary
Utah Water Pollution Control Board
Salt Lake City, Utah

William F. Sigler, Ph. D.
Chairman, Utah Water Pollution Control Board
Salt Lake City, Utah

Mr. David P. Green
Secretary, Stream Pollution Control Advisory Council
Wyoming State Department of Public Health
Cheyenne, Wyoming

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OTHER APPEARANCES

U. S. Public Health Service:

Mr. W. W. Towne, Deputy Chief
Technical Services Branch, WS&PC
Robert A. Taft Sanitary Engineering Center
Cincinnati, Ohio

Dr. E. C. Tsivoglou
Chief, Radiological Section
Technical Services Branch, WS&PC
Robert A. Taft Sanitary Engineering Center
Cincinnati, Ohio

Mr. Robert P. Morfitt, Sanitary Engineer
Division of Indian Health
Window Rock, Arizona

Atomic Energy Commission:

Mr. Lester R. Rogers
Chief, Radiation Safety Branch
Division of Licensing and Regulation
Washington, D. C.

Other Appearances: (Continued)

Mr. D. R. George
Division of Raw Materials
Grand Junction, Colorado

U. S. Geological Survey:

Dr. Franklin B. Barker
Research Chemist
Water Resources Division
Denver, Colorado

State of California:

Mr. Paul Mitchell
Imperial Irrigation District
California State Water Pollution Control Board
El Centro, California

Mr. W. E. Ripley
California Department of Fish and Game
Sacramento, California

State of Utah:

George W. Soffe, M. D.
Director of Public Health
Utah State Department of Health
Salt Lake City, Utah

Mr. Norman Chamberlain
Utah State Department of Fish and Game
Salt Lake City, Utah

Vaughn E. Hansen, Ph. D.
Director, Engineering Experimental Station
Utah State University
Logan, Utah

Union Carbide Nuclear Company:

Mr. Robert G. Beverly
Grand Junction, Colorado

Uranium Reduction Company:

Mr. Buford B. Winn
Moab, Utah

(A complete attendance roster is attached, as "Appendix A")

The conference met, pursuant to notice, at 9:30 A. M., January 13, 1960, in the Phoenix Library Auditorium, 12 McDowell Road, Phoenix, Arizona, Mr. Murray Stein, Chairman, presiding.

MR. STEIN: The conference is open.

This conference in the matter of pollution of the interstate waters of the Colorado River and its tributaries, and involving the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming, is being held under the provisions of the Federal Water Pollution Control Act. Under the provisions of that Act the Surgeon General of the U. S. Public Health Service is required to call a conference of this type when requested to do so by a State water pollution control agency. Six of the State agencies here represented have made such requests, and consequently, this conference has been called by the Surgeon General.

The purpose of the conference is to bring together the State water pollution control agencies, the Public Health Service, and the other interested parties to review the existing situation and progress which has been made, in order to lay a basis for future action by all parties concerned, and to give the States, localities, and industries an opportunity to take any remedial action which may be indicated under State and local law.

The conference mechanism is a time-tested and proven technique. It is used by many States informally in the normal conduct of business in the field of water pollution control. As long ago as 1921, the United States Supreme Court, in the famous interstate pollution case of New York against New Jersey, said "We cannot withhold the suggestion inspired by the consideration of this case that the grave problem of sewage disposal presented by the large and growing population living on the shores of New York Bay is one more likely to be wisely solved by cooperative study and by conference and mutual concession on the part of representatives of the States so vitally interested in it than by proceedings in any court, however constituted". This is, we think, equally applicable to the relatively complex water quality situation we have in the Colorado River Basin.

Under Section 8 of the Federal Water Pollution Control Act, the Surgeon General has notified the official State water pollution control agencies of this conference. These agencies are represented here, and because of the great number of them, we will have them introduce their names and official designations for the record a little later. Representatives of these official agencies are, of course, privileged to bring whomever they wish to the conference and have them participate in it. Representatives of these official State agencies and the Public Health Service constitute the conferees, and under the law this is a conference between these State representatives and the Public Health Service.

Representing the Public Health Service at this conference as conferee is Mr. Kaarlo W. Nasi, Regional Program Director for Water Supply and Pollution Control, with headquarters in Denver. My name is Murray Stein, and I am from headquarters in Washington. The State representatives will introduce themselves just a bit later.

Both the States and the Federal Government have responsibilities in dealing with interstate water pollution control problems. The Federal Water Pollution Control Act declares that the States have primary rights and responsibilities for taking action to abate and control interstate pollution. It has always been the policy of the Public Health Service to give full recognition to this traditional role of the States. The function of the Public Health Service is to encourage the States in this activity. However, the Public Health Service is charged by law with specific responsibility in connection with interstate pollution control problems. The Federal Water Pollution Control Act provides that pollution of interstate waters, whether the matter causing or contributing to such pollution is discharged directly into such waters or reaches such waters after discharge into a tributary of such waters, which endangers the health or welfare of persons in a State other than that in which the discharge originates, shall be subject to abatement.

The conference will be useful in providing a clear picture of the problem, delineating accomplishments, and indicating what still needs to be done in correcting the problem of interstate pollution of the Colorado River and its tributaries.

Under the Federal Act, the Surgeon General is required at the conclusion of the conference to prepare a summary of the conference, which will be sent to all conferees. The summary, according to law, must include the following:

1. Occurrence of pollution of interstate waters subject to abatement under this Act.

2. Adequacy of measures taken toward abatement of the pollution.

3. Nature of delays, if any, being encountered in abating the pollution.

Where the situation does not lend itself to the covering of all these points at one session, we have held conferences in several sessions. Succeeding sessions are held on the call of the Chairman after a reasonable opportunity has been given to develop additional information. If such proves to be the case here, it is suggested that consideration might be given to designating today's proceedings as the first session of the conference, and scheduling a second session in the future.

Now a word about the procedures governing the conduct of the conference. A recording and transcript will be made of the conference. Mrs. Mary Stogsdill, of the Public Health Service, is making a verbatim report of these proceedings for the purpose of aiding us in preparing a summary, and also providing a record of what is being said and done here. We will make copies of the summary and the verbatim transcript of the conference available to the State representatives. All others who wish to get copies will call upon their appropriate State to receive them.

All the conferees will be called upon to make statements. The conferees, in addition, may call upon participants they have invited to the conference to make statements also. At the conclusion of such statements, the conferees will be given an opportunity to comment or ask questions, and at the conclusion of the other conferees' comments or questions, I may ask a question or so too. In the past, this procedure has proved effective in developing a clear statement of the problem and reaching agreements on equitable solutions.

At this point we would like to go around the table and have the conferees introduce themselves, indicating their name and the official name of the agency they represent. For the record, we would appreciate it if the name of your water pollution control agency can be given exactly as it appears on your letterhead, because we do need the official designations.

DR. SIGLER: Dr. William F. Sigler, Chairman of the Utah Water Pollution Control Board.

MR. THATCHER: Mr. Lynn M. Thatcher, Executive Secretary of the Utah Water Pollution Control Board, and also Chief of the Division of Sanitation of the Utah State Department of Health.

Dr. George Soffe, who is the Director of Public Health in Utah, and therefore the Administrative Officer of the Utah State Department of Health, is also here, but happens to be in the audience instead of at this table.

MR. STEIN: I would suggest that when you introduce yourself, you might at the same time introduce people in the audience who have accompanied you.

MR. NASI: I am Kaarlo Nasi, Regional Program Director for Water Supply and Pollution Control, Public Health Service, U. S. Department of Health, Education, and Welfare, Region VIII,Denver. While I have this opportunity, I would like to introduce other members of the Public Health Service who have the program interest in the activities in which we are engaged.

First, Mr. Arve Dahl, who is Deputy Chief of the Division of Water Supply and Pollution Control, Public Health Service, in Washington.

Next to Mr. Dahl we have Mr. Jerome Svore, who is Regional Program Director for Water Supply and Pollution Control, Region VII, in Dallas, which embraces the State of New Mexico.

To Mr. Svore's left is Mr. Paul Eastman, Regional Program Director for Water Supply and Pollution Control, Region IX, in San Francisco. The San Francisco region includes the States of Nevada and Arizona.

We also have Mr. Oliver Placak, who is with the Division of Radiological Health, Field Activities at Las Vegas.

The other gentleman, who has just stood up to come forward, is Mr. Jack Detmer, the Regional Attorney for the Department of Health, Education, and Welfare, Region VIII, Denver. He is representing the Regional Director, Dr. Albert Rosenthal.

I should have mentioned earlier Miss Ruth Lauder, who is here from the Bureau of State Services, Information Office, Washington, D. C., covering our conference.

I want also to mention Mr. Charles E. Sponagle, who is in the far right of the room here. Mr. Sponagle is Chief of the Water Quality Section in the Denver office.

There are two others whom I will introduce in the course of the presentation. I don't believe I have overlooked anyone. Oh, Mr. Garry Fisk, in the far back, is presently on detail with the Bureau of Reclamation at their Region IV Office in Salt Lake City. Mr. Fisk is a Sanitary Engineer with the Public Health Service.

We have some representation from the Division of Indian

Health, and I am sorry I do not have all your names. Dr. Leland will introduce you, and you will get proper billing then.

I would like also, Mr. Chairman, to introduce official observers of several Federal agencies who have been told of the conference and invited to send representatives. I understand the representatives have indicated they do not wish to make any statements, but they may, if they choose, do so later on -- Mr. Paul Billhymer, Legal Counsel for the Upper Colorado River Commission, Salt Lake City; Dr. Franklin Barker, Research Chemist with the U. S. Geological Survey in Denver; Mr. Charles Hembree, of the Upper Colorado River Hydrologic Study, U. S. Geological Survey, Water Resources Division, in Salt Lake City; Mr. Cecil B.Jacobson, Chief of the Upper Colorado River Office of the Bureau of Reclamation at Salt Lake City; Mr. Joseph McCoy, Los Angeles District of the Corps of Engineers, U. S. Army.

Are there any other Federal agency representatives whom I may have overlooked? And now, Mr. Chairman, representatives of the Atomic Energy Commission: Mr. Lester R. Rogers, Chief of the Radiation Safety Branch, Division of Licensing and Regulation, Washington, D. C.; and Mr. D. R. George, of the Division of Raw Materials, at Grand Junction, Colorado.

Now I would like to turn back to Dr. Sigler, who has an introduction to make.

DR. SIGLER: I overlooked the fact, since I have such a large crew, that I brought along Dr. William T. Helm, of the Utah State University.

DR. LELAND: I am Dr. Stanley Leland, Director of the New Mexico Department of Public Health. I should like to introduce first, members from the New Mexico Department of Public Health: Mr. Charles G. Caldwell, Director of Environmental Sanitation; Mr. Robert Lowe, who is head of the Water-Sewage Section; Mr. Carl R. Jensen, our radiological expert -- and because New Mexico has a great affection for the Indian Health Service, we should like to introduce Mr. Robert Morfitt, who is Chief Engineer of the Navajo Reservation U.S.P.H.S. Division of Indian Health; and Mr. Lester Blaschke, Chief Engineer of the Albuquerque Area Office of that same organization. I have no others.

DR. CLEERE: I am Dr. Roy L. Cleere, Director of the Colorado State Department of Public Health, and I wish to introduce Mr. William N. Gahr, Director of the Division of Sanitation for the Colorado State Department of Public Health.

MR. GREEN: I am David P. Green, Public Health Engineer for the Wyoming State Department of Public Health, and Secretary of the Wyoming Stream Pollution Control Advisory Council.

MR. BONDERSON: I am Paul Bonderson, Executive Officer of the California State Water Pollution Control Board, and I should like to introduce Mr. Raymond Matthew, Chief Engineer of the Colorado River Board of California; Mr. O. F. Simmons, General Manager of the Palo Verde Irrigation District at Blythe, California; Mr. Paul Mitchell, a member of the Imperial Irrigation District, El Centro, and also a member of our State Water Pollution Control Board; Mr. Lowell O. Weeks, General Manager and Chief Engineer of the Coachella Valley County Water District; Mr. W. E. Ripley, representing the California Department of Fish and Game; and Mr. D. B. Willets, representing the Department of Water Resources.

DR. SALSBURY: I am Dr. Charles G. Salsbury, Commissioner of Public Health for Arizona. I would like to introduce Mr. George W. Marx, who is Chief Engineer and Director of our Division of Sanitary Engineering.

I would like to say as the host of this conference that we hope all of you who are not from Arizona are enjoying this slight "mist", which of course, we welcome after the hot sun which we usually have at this time of the year. We hope you are enjoying your stay in the "Valley of the Blessed Sun", as the news commentator usually refers to it, and if there is anything any of us can do to help you enjoy your stay, please do not hesitate to let us know.

Unfortunately, I will be unable to be present all day during the conference, but Mr. Marx will be here representing the Department.

I do not know whether we have any representatives from the State Legislature here this morning; if so, will they please stand? Senator Mickelson -- I had the misfortune to break my glasses this morning, Senator, and I could not recognize you at that distance. Our State Legislature is in session, and I do not know how many may be able to attend here today.

In addition, I invited Mr. Wayne Akin, of the Boundary Commission, and Mr. Biggleston, President of the Arizona Sewage and Waterworks Association. Is either of these gentlemen here?

MR. McNATT: I am Marvin McNatt, of the Arizona Interstate Stream Commission. Mr. Akin was unable to be here today, and asked me to represent him.

DR. SALSBURY: Thank you, Mr. McNatt. Is Mr. Tom Calhoun, of the Game Protective Association here? Mr. R. E. Polenske, Vice President of the Operations Department of the Arizona Water Company?

Thank you, Mr. Polenske. Mr. Robert Smith, Director of the Game and Fish Department? Mr. Russel Switzer, of the Arizona Power Authority? Mr. A. M. Ward, of Casa Grande? In addition to these folk, we invited our Congressional delegation, but they are in Washington. Are there any other Arizona State agencies represented that I have not named?

DR. CLEERE: May I ask Dr. Salsbury a personal question, Mr. Chairman? I am interested in knowing how he is always so adept at arranging the weather to fit the conference -- this is a conference on water, and the Valley of the Blessed Sun has cooperated by becoming the Valley of the Mist!

DR. SALSBURY: We made special arrangements with the Weather Bureau today, and appreciate their cooperation.

DR. HURLEY: I am Dr. Daniel Hurley, Acting State Health Officer for the Nevada State Department of Health. Mr. Wallace White, Director of Public Health Engineering, will be in later today.

MR. STEIN: Thank you. I think we can move on now with a review of the problem. The Public Health Service will present a general statement of the problem, and for that we will call on Mr. Nasi.

MR. NASI: Thank you, Mr. Chairman. The Chairman has very clearly stated the official interest and responsibility of the States and the Public Health Service in this matter of the interstate pollution of the Colorado River system. Under provisions of the Federal Water Pollution Control Act, the Public Health Service shares with the States here represented the responsibility for assessing the problem and for effecting remedial measures necessary to abate the pollution that is found.

This conference has been preceded, I should note,by earlier work by the State water pollution control agencies and the Public Health Service on problems of the Colorado River system. In 1950, these agencies cooperatively developed an appraisal based on the then available information and data, and outlined the basic steps toward development of comprehensive programs for safeguarding of the water resources. This program was presented in the PHS Publication No. 110, in 1951, by the Surgeon General. I think it is very encouraging to note that since 1950, the date of that program, much progress has been made in pollution abatement in the Colorado River system, most notably by the communities in the construction of waste treatment works. This has been brought about through expanded staffs and technical facilities. It has been brought about in some part by the Federal Water Pollution Control Act construction grants program.

We should note, however,that new and complex water pollution problems have developed during these years, and also that many problems significant then still remain unchecked today. We of the PHS would like to review briefly at this time the present problem of water pollution in the Colorado River Basin. This review will be given by two PHS engineers, whom I have reserved for introduction at this time, both of whom have had considerable experience here in the Colorado area, as well as in other areas of the United States.

Mr. W. W. Towne, who is Deputy Chief of the Technical Services Branch of the Division of Water Supply and Pollution Control, will review the over-all problem. He will be followed by Dr. E. C. Tsivoglou, who is in charge of the radiological pollution control studies in the Technical Services Branch of the Division, and who will discuss the radiological aspects of the total problem. At this time, I would like to call on Mr. Towne.

MR. STEIN: May I ask that all people other than the conferees who will make statements, go to the lectern to make their statements.

MR. TOWNE: I don't think I need to elaborate on the importance of the river system which we are today considering. I think we all know that it is one of the major river systems of America, and is instrumental in supplying water to that portion of America that is traditionally short of water. It is both an interstate and an international stream, and while the water uses within the basin are not yet fully developed, already water is being transported out of the basin, both from near the headwaters and near the mouth, or near the Mexico-United States border, to supply the water-short areas adjacent to the basin.

I think we all know and are familiar with (particularly those of you in the basin) the tremendous planning and construction now under way by both State and Federal agencies to supply additional water for further development of the natural resources of the area. These developments will also further stimulate population and industrial growth and expansion, and will place an increasing demand on the water resources that we are now about to discuss.

As Mr. Nasi has indicated, the PHS interest and active concern in the pollution problems of the Colorado River and its tributaries dates back some twelve years, when the first National Water Pollution Control Act was passed in 1948. Previous to that time the PHS, in its traditional role of working with, or assisting States, had had some minor contact, but had little or no responsibility with the pollution control problems of the area.

Mr. Nasi has mentioned the summary report that was put out by the Surgeon General in 1951, which was really the first comprehensive document from a pollution standpoint ever prepared on the basin. In carrying out the provisions of the Water Pollution Control Act, the Service established so-called River Basin Offices, and the Colorado River Basin Office was headquartered at Dallas, Texas. At that time the Colorado Basin States made certain requests to the PHS to assist them in evaluating certain phases of the pollution problem, and to interpret the significance of some of the pollutants.

About ten years ago we received the first request from the States asking for advice and counsel in helping them to evaluate the significance of radioactive materials. As you know, at that time we were just entering this radioactive age, and the Colorado Basin was abundantly endowed with certain radioactive materials that were being developed for the program. The PHS was limited in facilities that could be assigned to field studies, and the extent of our studies both in this field (which Dr. Tsivoglou will discuss in more detail) and to general pollution control problems were limited almost to reconnaissance type studies, spot checks on specific local areas, and minor specific problems

More recently, the PHS and two of the States have been engaged in a conference called under provisions of Public Law 660, the Federal Water Pollution Control Act, on a tributary of the Colorado River, the Animas River, which is an interstate stream arising in Colorado and flowing into New Mexico.

Still more recently, we have been requested by the Forest Service to assist in evaluating potential sites for forest products industries in the basin. We have also just recently received requests from some of the individual States for specific assistance not only on radioactive problems, but on general pollution problems as well, and it was felt that in approaching this we might well take these up as individual items. But you cannot tackle one job, or you cannot evaluate the effects of a single source of pollution, or of multiple sources of pollution from a single area, without considering these effects on the entire basin. In the evaluation of the pollution problems in the basin, when the request for the conference was made to the Surgeon General, we looked for data on sources of pollution both present and potential; the water uses, both present and potential; the sanitary quality of the waters of the basin; and the effects of water uses on this sanitary quality. Unfortunately, all water uses usually contribute to some degradation in quality. It is very difficult to use water without usurping some of its quality features. We found that the available data on these four most important points were rather limited.

We did determine, in a general way, the types of pollution sources, and I might briefly review these. Domestic sewage, of course, is the traditional source of pollution affecting public health and other water uses. This source of pollution in the Colorado Basin has not, according to our available information at the present time, reached the alarming proportions that we have observed in many other places, due to the sparsity of population.

Another source of pollution that has not yet raised its head to any great extent, but at least is an eventual source and a potential source, is one that I mentioned previously; that is from the industries to harvest the timber resources of the basin. These types of industry can contribute a significant amount of pollution to the receiving waters. We know that if we are going to make use of these natural resources, we must do more than let it grow on the mountain sides and die and decay. The resource agencies of the States, as well as the Forest Service and the U.S. Government, are much interested in making use of this resource to the benefit of the area.

We also know there are extensive coal and oil shale deposits in the basin. Many of you know more about the importance and significance of these than we do; but they are also potential sources of pollution. This will continue to increase as our population increases.

There are some major food processing industries that have a considerable pollution potential. Agricultural uses and agricultural drainage may also become a pollutant, as may some of the uncontrolled erosion from the arid and vegetation-free surfaces of this basin. We have some information, but we feel the problem will surely increase.

Both toxic and chemical pollution that will come with new advances in chemistry, the application of chemicals to soil for insect problems, etc., must also be considered.

And last but not least, we have the potential pollution from radioactive wastes. As I say, at the present time some of these pollutants are present in greater or lesser degree, but many of them are still potential.

In the area of water uses, we know that those uses that are vital to the welfare of the basin are domestic water supply, industrial water supply, water supply for agricultural use (including extensive irrigation use), and water for propagation of fish and wildlife. Recreational use of water is a rapidly growing resource in the basin and in the nation, and will continue to expand as our population increases and as our population centers grow. We also have the important water use of hydroelectric power generation.

The availability of data to the PHS necessary to evaluate the problem is quite limited, as indicated before. There are data available in the official State water pollution control agencies. Some of this is quite complete as of the present time, but I think it is generally agreed by both the States and us that there are many blank spots. As I indicated, up to this time our studies have been limited to more or less spot checks. We have some indications of the pollution, but we are completely lacking in sufficient data to pinpoint it, to pinpoint the effects, and to develop plans or programs that could adequately control it.

We know that other Federal agencies have data pertinent to this same subject. During the past three years the PHS has had an engineer assigned to the Bureau of Reclamation Region in Salt Lake City, working on the water quality aspects of the Bureau of Reclamation activities. I am sure that that agency has considerable information that could be of value and assistance in evaluating this over-all problem. The U. S. Geological Survey likewise has considerable information that we hope to call upon and bring into the picture. As of the present time we do not feel that the data are adequate to evaluate either the degree or the extent of interstate pollution. We do feel that the degree of pollution and the development of the resources of the basin are right now at a point that the problem can be one of prevention, rather than correction. In many of the older areas of the country the pollution control problem is largely one of correction, and I think all of us realize it is much easier, and generally much cheaper, to prevent something from happening than to correct the situation once it has happened. Furthermore, after a situation has been created, particularly in the field of water pollution, we find it extremely difficult to take the control back to the point where you can restore the water to the condition it was before the pollution occurred. If we could have exerted some preventive measure and some planning in the early stages, many of those stretches of streams now damaged for many water uses could have remained undamaged.

We think that such a preventive program in the Colorado Basin would preserve the sanitary quality of the water for the maximum use by all. It would permit the maximum development of resources with a minimum damage to water quality, and it would permit the States to develop reasonable and equitable pollution control measures as the problems develop. It would be an advantage to industry, to State regulatory agencies, and to the economy of the entire area if an intelligent plan to manage and protect the sanitary quality of the waters of the basin could be inaugurated.

What will this require? At the present time, we feel it will require the bringing together of all data from all agencies, as mentioned before; data on water quality; data on water uses; data on sources and extent and amount of pollution; data on resource developments and the effects that they might have on the water quality, both beneficial and detrimental. It would also require developing a water quality program to attain the aims and objectives that everyone in the basin, I am sure, is concerned with and is aiming for; namely, to make the waters of the basin useful and useable for all potential resource development programs, and for the maximum number of people.

Therefore, in the general field of pollution control at this time, we feel that the data are not yet available to properly evaluate the degree or extent of interstate pollution. There are indications that some may be occurring. There are other indications, and these are very positive, that this problem will expand and the problems will multiply rather than decrease, and that now we are in a position that we can develop plans to prevent serious interstate pollution in the future that would require interstate enforcement action. For that reason, we feel that this cannot be a final conference that would specifically define the extent and degree of the interstate pollution, but that first we must develop more complete technical data in order to determine how corrective measures can best be applied.

At this time, Mr. Chairman, I would like to have Dr. Ernest Tsivoglou speak to the point of what is probably the most significant source of pollution in the basin today, at least from a potential public health standpoint, and that relates to the matter of pollution from radioactive materials.

MR. STEIN: Mr. Towne, before you leave, first I want to thank you for a very excellent and comprehensive statement. We would like to call on the conferees now, to see if they may have any questions to ask you, or any comments.

MR. TOWNE: I would be very happy to try to answer them.

MR. STEIN: Does anyone on this side of the table have any questions or comments? If not, will you please proceed to call Dr. Tsivoglou.

DR. TSIVOGLOU: As Mr. Towne indicated, probably the most significant problem of pollution at this time in the Colorado Basin involves the question of radioactive wastes from the uranium ore industry. By this, we mean the industry is at present large enough in the Colorado Basin to be a contributor of radioactive materials in excessive amounts. A little bit later we will present some data to show what little we know at this time regarding the extent of such pollution. The wastes, of course, originate in the mills which perform the initial extraction of uranium from its ores. The uranium then proceeds to other installations outside the basin for further refining and fabrication into fuel elements. The

Colorado Basin presently contains twelve uranium refining operations, involving about one-third of the capacity of the United States industry in uranium refining. There is some information available regarding this kind of pollution in recent reports on the Animas River, and quite limited data for the Colorado River and its tributaries. We will talk about this a little bit later.

This whole pattern of radioactive pollution from industry is somewhat complicated by the presence of fall-out from nuclear weapons tests in the past. We know, for instance, that we have some Strontium-90 in the environment which contributes to human radiation exposure, and therefore, in its way, restricts the amount of waste that can be tolerated from more controllable sources. We know very little specifically regarding the extent of fall-out in the Colorado Basin. There is information available in various reports by scientists in other agencies than our own regarding average amounts of radioactivity from this source over the United States and over the world, but we have to be concerned also with specific localities which may receive radioactive wastes from other sources, such as industry. We do not know too much about specific amounts of fall-out from nuclear weapons debris in particular local areas in the basin. I believe it is fair to say that we do not have very good information regarding specific radioisotopes for the Colorado Basin on the average, either.

Mr. Towne has spoken about the potential pollution from other industries, such as oil shale, paper, and pulp. I think we have to consider that we will be working more and more with a rather different type of pollution than we have been concerned with so much in the past; that is, the long persistent chemical as well as radioactive pollution that may arise from various kinds of operations -- from the petrochemical and oil industries, as well as from uranium. We have to consider the possibility of thorium production sooner or later, because it may develop. Whether or not it will develop in this basin, I am not sure. But persistent, long-lived organic and radioactive materials must be expected in increasing amounts as we go along.

Now to discuss the hydrology of the basin, because it is pertinent. The basin streams generally are characterized by alternate periods of drought, or low flow, and flood. Typically, the spring floods start, as you know, in early April or the middle of April, and continue into the early part of June. The rest of the year the rivers run low, in what we would call in the statistical sense, drought conditions, and the available dilution is small. Some of the tributaries, and the smaller creeks especially, run dry at times, and available dilution in that case is zero. Others run nearly dry because of the heavy use of irrigation water in late summer when flows are normally low anyway. So we have this picture to contend with, either in the mainstem Colorado or its tributaries, of a stream which for nine months of the year runs fairly low in terms of available dilution, and during that nine months, lower at times. With the completion of the great storage reservoirs now under construction in the Upper Colorado Basin, some of these very low flows will be alleviated by storage of the spring flood waters, but I believe it will be a long time before this alleviation occurs generally over the basin.

We have gathered some information on water uses in the basin. As Mr. Towne said, they cover the entire gamut of legitimate uses of rivers. We do not have detailed information as to the extent of these uses, but such information is being gathered. For instance, in the near future I think the Service will release a report on the use of surface waters in the basin for domestic water supply for communities under 25,000. This information has been gathered mostly by the State water pollution control agencies, and will be summarized in the near future.

Regarding irrigation, of course, we all know this is an important use. We attempted to work up the total number of acres irrigated for the basin, but encountered some conflicting information and do not have a reliable figure now. We know it is extensive. Other uses include recreation, industrial process water supply, waste disposal, agriculture, and stock watering. Such uses are prevalent in the basin, either along the mainstem Colorado or its various tributaries.

As we have said, radioactive pollution is perhaps the most pressing problem at this time, although we do not believe it is serious. Nevertheless, the source of pollution is large enough to create some difficulties, and I would like to review a little of the available information. The interest of the basin States, the Upper Basin States especially, dates back to 1950. At that time Colorado, New Mexico, Arizona and Utah requested that we take a few samples to determine the extent of pollution and whether this problem involving the uranium industry was important or nót. In considering that, I think we have to realize also that we have been faced during that period of time with the development of standards. In 1950, when this request was made, there was not too much information available as to what were safe levels for human radiation exposure. Handbook No. 52, of the National Bureau of Standards, with which many of you are familiar, dates back to 1953, and the Addendum to Handbook No. 52 which suggests that a safety factor of 10 be applied to the Handbook No. 52 numbers, dates back only to 1957. So it is really only very recently that we have had what we consider reasonably firm estimates of what one can tolerate, and what is considered safe radiation exposure levels. Much of this information has to be interpreted in these terms. We just didn't know.

In 1955 and 1956 there were some very brief reconnaissance surveys made, again at the request of the States. In 1957 there was a four-State meeting at Cortez, Colorado, in which the possibility of a radium monitoring network was discussed and some planning was done. In 1958 and 1959 the Animas River study came along, and of course, that was only a single, small tributary of the basin, involving only one of the twelve mills located in the basin. In terms of the data we now have, I think some of you know that recently the Service inaugurated a series of water quality monitoring stations, not only for radioactivity, but for water quality analysis in general, of which gross alpha and beta radioactivity was considered an important part. We have a few results from four stations in the Colorado River Basin. They are located at Loma, Colorado, which is below Grand Junction and below the confluence with the Gunnison; at Lake Mead; at Parker Dam; and at Yuma, Arizona. All sorts of chemical, bacteriological, biological and radiological information is gathered. These, we should mention, are cooperative stations, operated by the PHS and the States involved.

I have a summary for 1958 and 1959 of the gross radioactivity data. It shows very little contamination -- nothing too much above background. At Loma, Colorado, there is some indication of a little more alpha and beta activity, but not too much. It must be borne in mind, however, that gross activity analyses are only screening information. For instance, in general terms we consider that 100 micromicrocuries per liter of gross alpha or gross beta is considered safe and reasonable, but it really depends on what radioisotopes are present. If it were radium, that would be much too much, because the number for radium is 4 ucc/l. If it were uranium, the water would be most safe, we might say, because the allowable amounts of uranium in terms of their human effects are much greater than 100 ucc/l. We really need more information than these gross activity analyses. They are a screen, or an indicator, in the sense that they provide us with leads as to where we should look further, but they are not an end result in themselves. When they do show us that we should look further, we have to go to specific radioisotope analysis. There will be two more water quality network sampling stations installed in the basin this year. One will be at Page, Arizona, and one at Aztec, New Mexico, on the Animas River.

To be more specific, we also have some data on dissolved radium content of streams of the Colorado basin. As well as I know, we have summarized all the available information, both our own and information gathered in its own research by the U.S.G.S. In one or two cases, the Animas River in particular, there is a good deal of information available, and we know something about what happens to these things in the river and the extent of pollution. In other cases we have only very little data that provide us with hints or indications of what may be, but does not give firm information on which we can base conclusions. These are usually random samples, grab samples as a rule, not composited over periods of time.

To give you a few numbers; on the mainstem Colorado River, above Rifle, Colorado, at several locations the dissolved radium concentrations are in the neighborhood of 0.3 uuc/l. If you would hold that number in mind, that is a typical natural background result. We have a total throughout the basin of about 40 or 50 background samples, in the sense that these are taken where there is no pollution that anybody knows about. The natural radium content of those waters is very consistent; it varies from less than 0.1 to about 0.7 uuc/l, and it averages out at 0.2 or 0.3. These samples, as I said, are both our own and those of the Geological Survey.

Below Rifle, Colorado, there are samples that have been analyzed by several people (the University of Rochester has done one or two). The mean value, the average, of the eight results is 1.1 uuc/l as against the 0.3, the natural background, and the 4 uuc/l that is considered acceptable for domestic water supply. The range of those eight results is 0.3 to 4.5. Again, let us bear in mind that these are random samples, taken without regard to river flow or industrial operations, so that it is hazardous even to give an average result, because it may not have real meaning.

Below Grand Junction, Colorado, we have taken from six or seven samples an average of about 1 uuc/l of radium. In a channel of the Colorado River above the confluence of the Gunnison, we have some considerably higher radiums in the vicinity of uranium operations, but these results are not representative of the mainstem Colorado River because it is a small channel, and sluggish, and not mixed with the Colorado itself. Three or four results here average above 100 uuc/l of radium. Downstream, when this becomes mixed with the Colorado, the figure drops to about 1 uuc/l. Below the confluence of the Dolores River with the Colorado River in Utah, we have results of 0.5, 0.8, and 5.5 uuc/l of dissolved radium. Below Moab, Utah, we have results of 1.0 and 1.3. Bear in mind, though, that these are random determinations. On the San Miguel River and the Dolores, we have some considerably higher values, again in the vicinity of uranium operations, ranging up to 50 and 60 uuc/l of dissolved radium. At the mouth of the Dolores before it joins the Colorado, we have values of 2.7 and 2.6 on the two samples which have been run. On the Animas River, there is a lot of information available. Perhaps the most representative figure is that in 1958, at the state line between Colorado and New Mexico, where we had about 7.6 uuc/l of radium. In 1959, a year later, as a result of the efforts of the company to reduce and abate pollution, that is down to 1.4 instead of 7.6. These are all dissolved radium figures. I will talk about suspended radioactivity in a moment. There are a few other results on background streams, but not very many, not too much worth mentioning here. These, as far as we are concerned, show a detectable but slight pollution with radium of the mainstem Colorado. Some of the tributaries contain somewhat more.

There is one very important effect. We have seen in the Animas River studies recently that the amounts of suspended radioactivity that are discharged to a stream have real significance.

When we started these studies four or five years ago, our initial guess was that radium is very insoluble, so we don't need to worry about suspended radioactivity. This has not turned out to be the case. On the Animas, about ninety percent of the dissolved radium in the river below the uranium refinery came about because of deposits on the river bed of radium-bearing solids -- spent uranium ore. Had there been good sedimentation practice in the past at the refinery; had we realized that this was a significant source of pollution, and the ore solids therefore not been released, the Animas would have been ninety percent better than we found it. These solids, of course, contain radium. It is not extracted at the refineries in any amount. They create a radium reservoir on the river bed and accumulate during low flow periods, to slowly and gradually dissolve out into the flowing water, providing a significant source of contamination.

We don't know too much about this kind of effect except in individual cases. For example, there are very recently published standards for the discharge or the release of radioactivity to the environment. They include suggested standards or recommendations for the amount of insoluble or suspended material that can be discharged, as well as for dissolved material. Recognition is taken of this problem. However, if we look at the numbers and apply them to the Animas River case, in essence that case would have been twice as bad if the effluents had contained those suggested amounts of suspended ore solids. Some of these standards have not been developed in terms of what happens to these things in the river; they have been developed in terms of what happens to radioactive materials when a human takes them into his body. They change in water. Some are taken up by the biota. Some of the radioisotopes that were suspended when discharged do not remain suspended, but become dissolved. Therefore, a lot of these industrial waste discharges have to be interpreted first in terms of the so-called fate in the water environment once they have been released.

We have a few effluent samples from some of the uranium refineries, radiums in the dissolved state, and gross alpha and gross beta radioactivities of suspended solids, but no radiums on suspended solids at this time. Samples from eight different mills contained from 4.0 to 4.5 up to almost 1,000 uuc/l of dissolved radium. These are the effluents before dilution in a receiving stream. We have also found that we may have toxic chemicals, nonradioactive, from the milling industry. We found this on the Animas. In that case, toxic materials from the organic solvents process nearly eliminated the bottom aquatic insect populations for some forty miles below the refinery. There is another case where a mill used to discharge all of its spent ore solids to a stream. These solids simply physically blanketed the river bed so as to smother out any biological life, and the biota were eliminated in that fashion; not by radioactivity, but by smothering. That case, incidentally, has been cleared up to some degree.

We have very little radioactivity information in terms of the Colorado Basin. We have some very limited information for one or two tributaries, and not too much more. We feel that we need a good deal more, and the ability to gather it and interpret it in terms of the entire basin, rather than approaching this on an industry-by-industry basis. We know, for instance, on the Animas River that the river bed is now pretty clean as regards radium deposits. The spring floods that came down last June flushed this material out, down into the San Juan, and perhaps into the Colorado. If we do not add to it any more, that situation should be in good condition. Especially, we feel that we need information on the accumulation of radioactive materials in the river biota and in the sediments throughout the basin, so we can begin to tell where the radium accumulates, and how long it stays there. Eventually, it will come to rest in the sediments of the great storage reservoirs, existing and planned. However, it is not necessarily true that this final dispersal will occur with the first spring floods. The solids may accumulate in a particular place for several years, until floods of sufficient magnitude come along to clean them out. We don't know where these effects may occur, and we cannot find out without sampling.

We have, then, some studies which we hope to do, and Mr. Stein may speak more about this. They are designed in terms of the preventive approach that Mr. Towne spoke of. I think it is clear that we have no general serious radioactive pollution problem in the Colorado basin, on the basis of the knowledge we now have. We have an indication of some slight pollution. There may be somewhat more serious local pollution problems on a tributary here or there, but the serious nature of these problems must be interpreted not only in terms of how much radium or other material there is, but also how much water use there is. There is one situation we know of where the degree of pollution is fairly high, but there is no water use that it interferes with before the river receives a lot more dilution. Such a situation is not nearly as serious as it would be were there immediate water uses - domestic water supply, etc. - involved.

We propose, then, to gather detailed information on water uses throughout the basin, with the assistance of and perhaps largely by the States involved. We propose to evaluate the sources of pollution, to gather detailed information on all sources and all kinds of pollution in the basin, especially to measure the present degree of radioactive and other pollution, and to try to determine remedial measures which appear acceptable and necessary. It will be necessary also to try to estimate potential pollution and its importance, and the ways in which it may interfere with water uses.

The kinds of pollution now present in the basin, or at least present in any large quantities, and that which we expect in the basin must be determined again in terms of the preventive approach; and we need to find out what these pollutants may do to water uses before we have to clean up the problem. In this way, we hope it will be possible to help industry to locate in places where it will not have difficulty, and to help it to develop in that fashion. This involves the measurement of a great many kinds of materials. We need to not only make measurements of what is present, but to develop analytical methods for what we expect. Radiological pollution, bacteriological pollution, and organic pollution, both persistent and short term, toxic chemical pollution, biological pollution, and bioassay studies need to be done on some of these wastes. The purpose is to try to help in developing a sound water quality management program or plan for the basin which will allow everyone to efficiently use all the water that is available, and to get the most out of it.

MR. STEIN: Thank you, Dr. Tsivoglou. Are there any comments or questions?

MR. THATCHER: Regarding the Animas River, I am not sure I understood your statement about removal of ninety percent of the radium. Are you speaking of ninety percent of the original suspended uranium?

DR. TSIVOGLOU: Yes. Ninety percent of the dissolved radium in the flowing water of the Animas River, by our measurements, arose not from dissolved radium discharges from the mill, but from suspended solids discharges that accumulated on the river bed. At that time there were some fifteen tons per day of spent ore solids coming out in the effluents and accumulating in the river below the refinery. Had that fifteen tons of ore solids not been discharged into the river; had it been held back by sedimentation or some such process, the river would have been ninety percent better in terms of dissolved radium.

MR. STEIN: Are there further questions or comments?

MR. BONDERSON: Has there been any attempt to make a gross estimate of the amount of dissolved or undissolved radium that has been discharged to the Colorado system since this industry has been initiated?

DR. TSIVOGLOU: We could make some horse-back guesses, and I would prefer not to try to give numbers on this. I can give a number that speaks about the potential. We estimated at one time that the industry in its entirety has a potential of about 5,000 grams per year of radium as wastes. Now, in the first place, only one-third of the industry is in this basin. In the second place, generally ninety-eight percent of that is retained as suspended solids in the tailings piles, and never gets to the rivers. In terms of what actually has happened, I don't think anybody can make too good a guess.

MR. STEIN: Are there any further questions or comments? Dr. Tsivoglou, I wonder if I understood you correctly in analyzing the kinds of wastes you were talking about, that radioactive and toxic wastes have a much longer life in the stream, and persist much longer, than wastes say from a pulp and paper industry, or domestic wastes.

DR. TSIVOGLOU: Generally, we have concerned ourselves in the past with things that had immediate effect. For instance, if we had a paper mill that discharged much fiber, we might have a sludge deposit in the river that would putrefy, and we would have rapid diminishment of dissolved oxygen in the river, perhaps down to zero oxygen, and no aquatic life. If we stop discharging fiber, very soon the river starts to clear itself, dissolved oxygen comes back, and fish come back in a matter of a few months. These are short term things, in the sense that they don't last too long.

In this case, of course, Mr. Stein has in mind that radium has about a 1,600 year half-life, and therefore there may be residual contamination which lasts a long time and stays with us a long time.

MR. STEIN: I would like to emphasize one other point. In the Colorado River, you get a large run-off during a very small period of the year. During other periods of the year, the streams may have very low flow. In other words, discharges to the streams which may be tolerated by the large flows of water because of the dilution factor may become critical pollution problems during the periods of low flow.

DR. TSIVOGLOU: That is correct. In a typical station at Loma, Colorado, or at the Utah-Colorado line where the Colorado River enters Utah, we analyzed the last flow record published by the Geological Survey and estimated that during an eighty-day period in the spring, sixty-seven percent of the annual flow went down the river. So, you have thirty-three percent of the flow left, to cover essentially nine months. That gives some estimate of the extent of floods and droughts.

MR. STEIN: I would like to ask you just two more brief questions. Dr. Tsivoglou, on the basis of your experience on the Animas, would you say that if a situation were discovered where a uranium milling operation was putting excessive radiation into a stream, or excessive radioactive materials into a stream, that remedial action could be instituted in a relatively short time, and that such remedial action is feasible?

DR. TSIVOGLOU: Yes, I would say so. I think that Mr. Lester Rogers is here, and may want to comment on that later himself.

MR. STEIN: I have just one more question. As I understood your statement, you indicated that we could not always get a clear picture of a pollution situation in a stream just by applying perhaps existing effluent standards. It would be necessary to make a pretty thorough examination of the stream itself.

DR. TSIVOGLOU: Let's put it this way. As we learn more about what happens to these things as they go into a river, the extent of the investigation diminishes. We do not have, for instance, to do as extensive a local study in the future as we have done on the Animas. We did not know what happened to these materials when they got into a river, and we learned something from that study. On the other hand, in the whole history of water pollution, at least as I see it, it has been essentially impossible to apply a single standard to all industry of a certain type. Local circumstances govern things to a large degree; the amount of available dilution water, and how long it lasts; the water uses that are downstream -- there are a lot of things that make us treat these as individual problems. This is not in the interest of research, but in the interest of protecting and assisting industry and communities to the extent that we do not put too restrictive a standard on them.

MR. STEIN: Sir, did you want to come up here and ask your question? Would you announce your name and organization, and just ask Dr. Tsivoglou your question.

MR. RIPLEY: My name is W. E. Ripley, and I represent the California Department of Fish and Game. The question I would like to ask is this. The results of the survey that we have been listening to today seem to depend mainly on the aquatic water solubility of radium and the suspended material that is deposited in the river. Have you been able to do any biological studies to determine the path of the uptake, and what concentrations take place in the biota of the streams below?

DR. TSIVOGLOU: The answer is yes. We have done some of this kind of work on the Animas River, and in one or two other locations. We could go into detail, and I could stay here all day, but I don't want that any more than the rest of you. I will just say that in river algae we have had concentrations of radium in quantities up to 800 or 900 or 1,000 times the background amount, which would be the radium content of such algae in unpolluted locations. In terms of crops, we did learn a little on the Animas River. We learned that there was some uptake of radium in crops from water that had dissolved radium in it. The degree of uptake, fortunately, was small, to the extent that as well as we could tell from the samples we had, the radium content of crops gained on the average of a factor of about two, so that while there was some uptake, it was in small degree.

MR. STEIN: May I make just one comment. I think in this measure we have almost a scientific detective story. During the Animas study, part of the investigation was to examine precisely what the question was directed at, the uptake of radioactive materials by the biota of the stream, not just finding the dissolved radium in the water as it went by. When our biologist went up there, lo and behold he found, as far as animal life was concerned, a biological desert which was typical of a lethal dose of some toxic material. In combination, Mr. Sponagle, who is here today, was making an analysis of the mill process and discovered that organic raffinates were escaping which acted to kill all the fish life and a considerable portion of the organisms on which the fish fed, below the mill. This gives us a little of this picture. We went out to find the organisms, and found the lethal material being put into the stream which eliminated the organisms. This was one area where the plant management was very happy to get information, because the material being discharged which was affecting and killing the organisms were rather expensive extractive chemicals which cost considerable money. They were most anxious to save them and keep them confined, rather than lose them in the stream.

DR. TSIVOGLOU: At the risk of being repetitive, I would like to make it very clear that the toxicity problem was a chemical one, and not a radioactivity problem. It was not radioactivity downstream that damaged the biota; it was toxic chemicals.

MR. STEIN: If there are no further questions, we will have a brief recess for ten minutes, and will try to reconvene promptly.

MR. STEIN: The conference is reconvened.

I would like to make a few announcements. The first relates to the map. When we got here, we discovered that we did not have a map, and decided to try to get one, just in case one was needed. We did the best we could on such short notice. The map we got is from another Federal agency. I am informed that the figures on the map have absolutely no meaning. We know one of the difficulties in dealing with this. Remember, we are dealing only with water quality. We are not dealing with apportionment of water, or in controversies between or among States, and if these figures have any bearing either directly or indirectly on that, we were told by the people who lent us the map that they have no bearing. The sole purpose of this map is to indicate in general terms the Colorado River and its main tributaries, and the way they flow. I ask you again to please disregard the figures.

I would like to again call upon Mr. Kaarlo Nasi, to see if he has any more representatives of the Public Health Service.

MR. NASI: Thank you, Mr. Chairman. I would like to have Mr. Robert Morfitt, who is Sanitary Engineer with the Division of Indian Health of the PHS, make a brief statement concerning the interest of that Division of the PHS in the matter we are discussing today.

MR. MORFITT: Thank you, Mr. Nasi.

I represent the Division of Indian Health Albuquerque Area Office, which has the health responsibility of Indian people in a portion of the drainage area. Roughly speaking, the Indian lands involved are bounded on the west by the Colorado River, on the north by the San Juan, on the east by the boundaries of the basin itself, and on the south by the Little Colorado River. The Indian leaders and people are greatly concerned with water quality, and should the conferees decide to do a study of the water quality, the Indian people and the Division of Indian Health would extend their full cooperation on any data collection or study activity in this area of the basin, and will be available to assist the conferees in any way that they might request our services. Thank you very much.

MR. NASI: Thank you, Mr. Morfitt. Mr. Chairman, that concludes the PHS presentation.

MR. STEIN: At this time we would like to call upon the States for their statements, and will do this in alphabetical order. The State of Arizona -- Mr. Marx.

MR. MARX: First, I would like to briefly review what has led up to this conference today. As Dr. Tsivoglou mentioned, some of the State sanitary engineers in the Colorado River Basin became interested in what was occurring regarding the radioactivity on the River. There was a meeting called early in 1950 at Durango, at which we had an opportunity to observe operations and what was going into the Colorado. At that time it did not mean too much to us, as we did not know what it all meant. We did request that the PHS look into the matter.

Following that, the PHS did some spot checking, and our first meeting regarding the possible degradation of the Colorado River and its tributaries was held at Cortez, Colorado in 1957. That meeting was called between the sanitary engineers of the four corner States and engineers and scientists of the PHS. There was an exchange of information, and some idea of planning. Results of the spot sampling analyses indicated that we needed more information. The information was quite meager, and could not be evaluated at that time, but it was a good indication that further studies were needed, and that there

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was a possibility of some health hazards developing.

The first step at that time was to concentrate a comprehensive study of the Animas River,which had just one uranium processing mill, at Durango - and Farmington and Cortez below were taking their drinking water from the Animas River. The New Mexico and the Colorado State Health Departments requested the Surgeon General to hold a hearing at Santa Fe, New Mexico in 1958. My good friend Dr. Leland invited me to attend that conference as an observer. As a result of that meeting, the PHS undertook to do this comprehensive survey, and I believe they spent some fifty thousand dollars on the survey. The report of that survey was made at Santa Fe in June 1959. Again I was invited to attend. The report confirmed our concern,and indicated that a complete basin study should be made.

The report was made public, and sometime later, possibly a couple of weeks, the news of that report appeared in the Washington papers. Congressman Udall from Arizona read it. He wired both Dr. Salsbury and myself, expressing his concern, and suggesting that we request the PHS to make a more extensive survey of the whole Colorado River Basin. We felt the same way. Dr. Salsbury and I decided that it would lend weight to the request if we could find out if the other States felt as we did, and would join us in this request. This was done, and this conference is the result.

I might mention another meeting which was called by the Atomic Energy Commission at Grand Junction several years ago. At that meeting, the State sanitary engineers were invited, several Federal agencies such as the Bureau of Mines, as well as the AEC officials. All of the agencies, Federal and State, were given an opportunity to state their authority, responsibility, and policy regarding water pollution problems. I think this was a good meeting, in that it provided both the AEC and the various other agencies with information of value. Since that time we have been kept informed regarding licensees, isotope users, reactor installations, and any time the AEC officials come into the State to make an inspection, they inform us ahead of time and invite us to join in the inspection. This has been done for the last two or three years. That points up this conference.

Now regarding Arizona -- what are the interests in the Colorado River water quality? Colorado River water has multiple uses in our State. We start at Glen Canyon. There will be, in the future, a large lake formed which will be utilized not only by Arizona for recreation, but by Utah as well, because this lake will extend for some distance into Utah. The Park Service, I am informed, has plans on their drawing boards to develop quite a recreational area at this place. This will include swimming, boating, fishing,water skiing, etc. In addition to recreation, Page, which is the community where the Glen Canyon is being built, uses that water for domestic purposes.

We move down the river to Lake Mead, formed by Hoover Dam. There we have recreation and domestic use, cattle, and cattlemen taking drinking water from the river. Farther is Lake Mohave, another recreational area and domestic use of groundwater, these wells being located on the periphery of the lake. The water in Lake Mohave is used by sportsmen, fishermen, and others for drinking purposes, and we know that even though they may chlorinate or boil the water, it will not remove the radioactive material. Davis Dam, which impounds Lake Mohave, has a community which uses the river water as a source of domestic water. Still farther, we come to Lake Havasu. There we also have recreation, considerable fishing, etc. Mr. Bonderson knows that this is one of the big sources of water for Los Angeles and San Diego. Below Parker Dam, which forms Lake Havasu, we have domestic, irrigation, recreation and fishing; in the Yuma Valley, irrigation; for the community of Yuma, the sole source of water is from the Colorado River.

Below the border we have Mexico, where vegetables are irrigated and returned to the States. As we know, the plants take up radioactive materials, and beef animals are fed and they ingest whatever radioactive material may be in the feed. We ingest whatever may be in the vegetables. This gives us considerable concern, in this age of radiation, so in developing a program, or requesting the PHS to extend their survey into a comprehensive one of the entire Colorado River Basin, I would like to state some of the things that I would like to see the PHS and the various States involved do.

First, to determine the pollutants and their concentrations. This would include perhaps our principal concern, radioactive materials, primarily radium, dissolved and undissolved; gross alpha and beta radioactivity; the chemicals used in refining uranium, such as the sulphates and the nitrates. We would like to see biological and microbiological studies made, and we would like to see them determine the sources of pollution and the potential sources of pollution,which would include, as indicated in the Animas River study, that there are other pollutants besides radioactive materials, such as community sewage and garbage, industrial wastes from the shale oil industry, and potential pulp mills and other industrial developments. We would also like to know the significance of agricultural waste waters in this chemical age of ours, of highly toxic insecticides and synthetic fertilizers which are applied to the land and directly to irrigation waters. Other potentials are summer camps. We need also in such a program, a physical engineering survey of existing waste disposal methods and facilities, community systems for sewage, garbage, and other wastes, and industrial treatment of wastes.

Then, an evaluation of the information obtained by these surveys should be made, and the more urgent problems eliminated as rapidly as possible. In other words, setting up a priority for eliminating the various contributing pollutants that may exist. This can be done under the authority of Public Law 660, and State laws where they exist. I realize this is a vast undertaking, but it is an opportunity to really put into practice a preventive public health program before the problem gets out of hand. Many of the radioactive waste products from the uranium refineries have a very long half-life; radium, for instance, some 1,400 years. It is not too hard to realize that continued pollution of the stream beds with even low level concentrations will continue to build up concentrations which may become quite hazardous, and cannot be removed by ordinary water treatment methods. Aquatic vegetation and fish life will become so contaminated that they will become unsafe for use. We should take a lesson from the highly industrialized centers of the Midwest and the East, where pollution of streams has become so great that corrective measures are difficult, if not impossible in some instances.

What is Arizona doing in their water pollution program? We have one uranium refinery at Tuba City, on the Indian Reservation, but located far enough away from any stream to be a problem in that relation. Regarding industrial and community wastes, we require complete treatment of wastes before entering any stream, or even a dry stream. We are thus in a position to prevent any stream pollution if we can maintain an adequate staff in this program. We are not in a position to control pollution occurring in the Colorado River in other States, so we must rely on the PHS to provide the control and elimination services, together with whatever elimination services the other States can provide. There is only one community in Arizona discharging raw sewage into the Colorado River. This has existed for many, many years. This pollution does not have any significance as far as our States are concerned, but may eventually result in an international problem. As I mentioned, that water is used for irrigation of vegetables in Mexico, which come back to the States.

We have, with PHS collaboration, set up four basic data sampling stations, at Yuma, Parker, Hoover Dam, and recently the one at Page has been put into operation. It is my sincere hope that this problem can be resolved in the very near future. I know it is a great undertaking, and will probably be expensive. As I understand, it will take some half-million dollars a year for several years to really bring the problem under control. In resolving this problem I have no doubt that some research will be necessary, in order to determine methods and processes for eliminating some of the more complex pollutants which, no doubt, will be found. We urge the PHS to take on this project as provided in Public Law 660. We frequently become more concerned about the unknown than we do about what we do know. We will feel this concern until we know the actual facts, and what is being done about them.

MR. STEIN: Thank you, Mr. Marx. Are there any comments, or questions?

In order to underline what Mr. Marx said, in one of our other areas, in the Midwest (and this is in contrast to what you have here), in an analysis of pollution, we had occasion to go into the water plants. This turned up just as a byproduct of the study. One plant, representing a very large city in the Midwest, has been running an excellent water plant, and keeping good records. We found that in 1923, the earliest records we could find, the water plant operators were putting five pounds of chlorine in a million gallons of water, for treatment. You can follow that, year by year, as the amount crept up, and you could almost plot a beautiful curve. They are now well over sixty pounds per million gallons -- from five pounds in 1923.

Can you wonder where we are going? And when you get the problem of trying to turn some of that back, and restore that stream, you really have a tremendous problem, brought about by the impact of population and industrial growth. In this area, we are very fortunate to be able to come to grips with this problem before we are faced with situations of that kind.

Now, may we call on the State of California - Mr. Paul Bonderson.

MR. BONDERSON: Four major agencies in California hold established rights to the use of water from the Colorado River. They are the Metropolitan Water District of Southern California, the Imperial Irrigation District, the Coachella Valley County Water District, and the Palo Verde Irrigation District.

The Metropolitan Water District embraces an area of more than 3,000 square miles, with a present population in excess of 7,000,000. The District includes the San Diego County Water Authority and covers substantially all of the coastal plain in Los Angeles, Orange, Riverside, San Bernardino, and San Diego Counties. The main aqueduct delivering Colorado River water to the District is 242 miles long, and has a full capacity of 1,605 cubic feet per second. During the first year of operation (1941-42) the annual delivery was approximately 1% of full capacity. Today it is almost 50%.

The Imperial Irrigation District is the largest single operating irrigation project in the United States. It comprises more than 1,400 square miles in the arid Imperial Valley. The only source of water supply for this Valley is the Colorado River. Development of the Imperial Valley was started in the 1890's. The District is served by the All-American Canal, which also serves the Coachella County Water District lying north of the Salton Sea. The two districts are currently using more than 3-1/4 million acre-feet of Colorado River water annually.

The Palo Verde Irrigation District borders the river in the vicinity of Blythe, California. The first filing for use of river water in this area was made in 1877. Over 350,000 acre-feet of water are now being used annually.

The primary municipal and industrial uses of the waters of the Colorado River are for supplementing the water supply in the arid coastal plain of southern California. Prior to construction of the Metropolitan Water District Aqueduct, the sources of water supply in this area were the local surface and underground waters and the Owens River Aqueduct of the City of Los Angeles. By 1941, these limited sources were being utilized to their full capacity. The Metropolitan Water District now makes Colorado River available to seven million people living in the coastal plain.

Since no other sources of water are available, all of the communities in the Imperial Valley are dependent upon the Colorado River for their domestic water supply.

The major use of Colorado River water is for irrigating the desert region of California, chiefly the Imperial, Coachella and Palo Verde valleys. Of the 900,000 acres in the Imperial Irrigation District, approximately 500,000 acres are now irrigated and producing crops; and about 250,000 acres remain to be developed for irrigation. The Coachella Valley County Water District comprises about 138,000 acres of irrigable lands, and has developed more than 75,000 acres for irrigation. The Palo Verde Irrigation District embraces an area of 122,000 acres, of which substantially two-thirds are now under irrigation.

During the past twenty years there has been a marked increase in the recreational use of the lower Colorado River for fishing, boating, water skiing, swimming, and other water-contact sports.For example, between 1955 and 1958 the number of Colorado River angler permits sold by California and Arizona increased from 36,000 to 49,000 annually. In addition to the proposals of the National Park Service for development of recreational areas along the lower river, the California State Division of Beaches and Parks is now developing a park site of approximately 13,000 acres in the Imperial Dam area, and is considering another site north of Blythe. A local recreational district also has been formed near Parker Dam.

Waste discharges into the Colorado River from California communities are few in number, and involve relatively minor flows. The largest is that of the City of Needles, which discharges secondary-treated (oxidation pond) sewage from a population of slightly more than 4,000. The small community of Parker Dam and the quarantine station of the California State Department of Agriculture near Blythe both discharge septic tank effluent to percolation ponds that under-drain to the river. The U. S. Bureau of Reclamation Camp at Parker Dam discharges its septic tank effluent to leaching fields. Effluent from the City of Blythe treatment plant is discharged to percolation beds, rather than to the river. The communities of Imperial Dam and Earp provide primary treatment. The small community of Palo Verde does not treat its sewage.

Minor discharges to the river also result from squatters' settlements on the California side of the river, chiefly along a fifteen-mile stretch below Parker Dam, and to a lesser extent below Imperial Dam.

More than half of the citizens of California depend in whole or in part on the Colorado River as a source of domestic water supply, and the desert area on California's side of the river is entirely dependent upon the river for agricultural and domestic water. The State, therefore, has a great interest and concern in water pollution control and water quality protection of this vital water resource. This concern extends not only to the commonly recognized pollutants of public health significance, but also encompasses the chemical or mineral characteristics of water quality as it pertains to agricultural, municipal, and industrial use.

The maintenance of quality of Colorado River water at levels suitable for the various beneficial water uses is important to all of the States in this river basin. Because of the increasing use of the waters of the Colorado River and the lands adjacent to the river, it would appear that there is an urgent need for development of a comprehensive water pollution control program for the entire Colorado River Basin.

In our opinion, an effective pollution control program can only be formulated and carried out if there are available both reliable and adequate basic data. With this in mind, we would encourage the U. S. Public Health Service and other Federal agencies, with the cooperation and assistance of the basin States, to initiate a comprehensive study of the river for the purpose of considering and evaluating all water quality characteristics involved in the use and development of these waters.

Water pollution control authorities recognize that abatement and prevention of pollution is but one aspect of a total water-quality management program. These authorities can regulate and control only that phase of water-quality management stemming from the discharge of sewage and industrial waste. However, in exercising such control, and in evaluating waste assimilative capacity of a receiving water, agencies such as ours must consider not only the effects of existing and future waste discharges, but also must take cognizance of other basin-wide factors and developments which influence quality characteristics of the receiving waters. We feel this is particularly essential in a drainage basin such as the Colorado.

In event this conference results in the initiation of a cooperative water-quality study of the Colorado River, I can assure you of California's active participation and whole-hearted cooperation in this worthwhile effort.

That concludes my statement, Mr. Chairman. However, our State Director of Public Health was not able to be here today, and I wonder if it would be appropriate for me to read a portion of a letter that he has sent to me.

MR. STEIN: Certainly. You may insert it into the record, if you wish.

MR. BONDERSON: This is a letter dated December 31, 1959, addressed to me, from Dr. Merrill, reading in part as follows:

"Public drinking water supplies in Southern California from local sources are insufficient for present and future needs. Imperial County and San Diego County depend on Colorado River water for most of their agricultural and domestic water supplies. Los Angeles, Orange and Riverside Counties also use large proportions of Colorado River water, and the use increases with population growth.

This Department is charged with the responsibility of supervising the delivery of pure, wholesome, and potable water to the consumers of domestic water systems. It is charged with the duty of investigating the sources of domestic water supplies in the State, and may prevent the pollution of domestic water and ice supplies. The Department, therefore, has a great interest in the Colorado River as a major source of domestic water supply for more than half the citizens in this State. Water quality protection and water pollution control of the Colorado River depend on the cooperation of all States in the basin. Basic data on the quality of water from each major tributary, if not presently available, should be gathered by some Federal, State, or other appropriate agency. A program of sample collection and analysis should be developed, similar to the stream sampling program in California. Physical, chemical, bacteriological and radiological tests should be made on the samples. Other special tests may be required, if unusual wastes are allowed to be discharged into the river system.

Naturally, we should like to have the water reaching California no more highly mineralized than at present. We would prefer, if possible, to have water of lower mineral content. Land drainage may be an increasing source of mineralization of streams. We would, therefore, urge that all plans for future land use be studied in determining possible effects.

Please assure the group of the interest of this Department, and its specific responsibilities, and my personal interest as a member of the State Water Pollution Control Board of California. Signed, Malcolm Merrill."

MR. STEIN: Thank you, Mr. Bonderson. Are there any comments or questions? If not, may we call on the State of Colorado - Dr. Roy Cleere.

DR. CLEERE: I shall make a few brief remarks, then call on Mr. Gahr.

First, I wish to express my appreciation to the Surgeon General of the PHS for calling this conference following requests from stream pollution control authorities of seven States of the Colorado River Basin. I sincerely hope that this conference today will lay the groundwork for the complete stream pollution control survey of the Colorado River Basin.

Colorado, as you know, occupies a rather unique position. There are four major rivers originating in Colorado, one of which, of course, is the Colorado. There is only one stream originating in another State which courses through a small section of the State of Colorado, and that is the Green River, represented here today by Mr. Green, of Wyoming. Colorado, in other words, is sitting on top of the pollution problem.

With reference to the Colorado River Basin area in the State of Colorado, there are approximately four hundred uranium mines located on the Western Slope, a section of the Colorado River Basin in the State. There are seven uranium processing mills in the State, six of which are located on the Colorado River or its tributaries. We are anticipating that a paper pulp mill will also be located on the Colorado River in the vicinity of Glenwood Springs. Undoubtedly, there will be exploration of shale for extraction of oil, which, of course, can add to the pollution problem.

I wish to reiterate the statement by Dr. Tsivoglou that in spite of several excellent studies conducted on small tributaries of the Colorado River, there is still comparatively little information available as related to the information we should have in order to plan effectively a control program. To me, the appropriate approach is on a river basin basis, and I hope it will be possible for the PHS to formulate a budget and a plan for the conduct of the study to which I previously referred.

MR. STEIN: Any questions or comments? Mr. Gahr.

MR. GAHR: I am Bill Gahr, of the Colorado State Department of Public Health, and I should like to continue along the line of Dr. Cleere's remarks.

It is our feeling that there is a need for a comprehensive study of the water pollution problem in the Colorado River Basin. The reason behind that is that water resources are here on the face of the globe, they are used by man, and while this does not mean that it is an opportunity for man to destroy himself by destroying the natural resources, he must realize that he has to make a living and he has to make use of agriculture, industry, and the things that go with it. There seems to be a need for establishing in our river basin areas a water pollution tolerance level, if you please, and this must be fixed by some intelligent and scientific approach. At the present time, in spite of the progress that has been made on a very small segment, the Animas River, in the Colorado River Basin, we still lack very much the scientific knowledge with which to formulate some sort of intelligent control level. At least, that is my belief.

It has been indicated that industry is developing in the upper basin of the Colorado River. In fact, population is growing, industry is growing, and agriculture continues to expand throughout the entire basin. This needs to have further examination to determine the size of it, so that it can be correlated with the water resource potential within the entire basin. This leads back again to our immediate and specific problem that we need to know on a scientific basis a good deal more than we now know. This, of course, calls for an investigation, and it is timely. I think Brother Marx has indicated that we surely need to proceed -- I don't know that he said with great speed -- but we should proceed, and the time is growing later daily.

In consideration from our point of view of the size of the problem, looking at the map, and sticking strictly to the geographic boundaries, and not considering the numerical values on it, you can see that in our State we have a considerable area to cover. The map does not indicate the very large number of tributaries that make up the Upper Colorado system, and all of these have to be looked into, because there is natural pollution, as well as man-made pollution. I think we can all agree that pollution is the responsibility of all areas. It is not just characteristic of one particular area in the geography. It comes about all over. Getting back to the size of the problem then, we would expect to have to cover on a basic water quality pollution survey, a good size of geography. Included in that, of course, are many miles of territory to be traversed many, many times, in the collection of water samples.

As you know, the PHS has a number of basic water quality stations throughout the nation. We happen to have one each on the eastern and western boundary of the State of Colorado. The one of interest to you is at Loma,Colorado, where sampling has been going on for over a year. This gets to be a tedious job, a job of considerable volume. To be worthwhile, it has to be conducted for many years. However, the results from these studies have great value, because they indicate what is going on. When you have an opportunity to find out what is going on, you can intelligently bring about a program for control.

I would estimate the size of such a job in our State would require about eleven people. This will include supervisory people, field staff, people in the laboratories, and clerical support. Of course, this would extend to the entire State, but with growth in population comes growth in industry. This immediately brings about individual problems that must be studied. They are worthwhile studying for one industry, and worthwhile for all industries.

Agriculture has its problems. Reference has been made to the pesticides and chemicals that get into the water. There are many of these things that come with our civilization, and we have just not kept up with them. It is appropriate to remark that waterworks plant operators have for years been concerned with the bacteriological content of water, and this has been good. Most of the time, that has been the principal work. Now, we have in that field other things -- viruses, petrochemicals, detergents, surfactants. We are now going to have industry, with developments that will bring unknown contaminants.

It is, therefore, time we got busy on a comprehensive study. It seems most necessary, if we are going to have an intelligent administration of pollution control. Pollution control is necessary because it augments our water resources by bringing back into use additional water -- water to be used and reused many times. All of this requires scientific investigation. The cost of it is such that we do hope the PHS can get into the problem, because research will be necessary that is beyond the scope of many of the States. It is really not logical for each State to embark on a research project in the same area, so it makes sense that some central agency ought to do that. No doubt, great cooperation is possible among the States, and with the Federal agencies, and we would expect this to develop.

MR. STEIN: Thank you. Are there any comments or questions? If not, we will call on the State of Nevada - Dr. Hurley.

DR. HURLEY: I am very sorry that Mr. White is not here to speak, as he could do so much more authoritatively than I can. Of course, we are interested, in Nevada, as users of water from Lake Mead. Forty percent of our population lives in the vicinity of Las Vegas, and the rapid growth in that area would not have been possible without the water from Lake Mead. Lake Mead is also a very prominent place for recreation in our State.

Unlike Colorado, there is only one stream in Nevada that runs out of the State.

I wish to thank the Surgeon General and the PHS for calling this meeting, and we will promise to cooperate in any way.

MR. STEIN: Thank you, Dr. Hurley. May we now call on the State of New Mexico - Dr. Leland.

DR. LELAND: Following the example of Dr. Cleere, I would like to make a few statements and then call upon Mr. Charles Caldwell to express the opinion of the State of New Mexico and its action in light of this proposed possible program.

I would like to cite to you the importance of the Animas River as the example of what can be done, what had happened, and indeed, what might have continued, had action not taken place. It is not the one instance, but it is certainly the outstanding instance of a collaborative enterprise. If anything, in terms of planning consideration, it brought to light the fact that existing law, existing regulation, and existing procedures in agencies and States are not sufficient to prevent water pollution. Even its curative value under these laws and regulations is somewhat questionable. The fact that the Animas River has, to a great extent, been controlled in its pollution aspect, has been due not so much to a legalistic situation, but rather to a collaborative situation in which PHS, AEC, the mill itself, the States of Colorado and New Mexico, all collaborated in improving a situation, without respect to what was absolutely necessary under law and under regulation. This, I think, will be highly necessary in considering the Colorado River and its tributaries. I feel that this point must be borne in mind, and with this admonition, I should like to call upon Mr. Caldwell.

MR. CALDWELL: I am Charles G. Caldwell, of the New Mexico Department of Public Health.

We are gratified that so much attention was brought to the San Juan problem. For the benefit of those of you who might not understand it, we use the San Juan River as a source of domestic water supply for Farmington, Aztec, and other installations up there. This survey has been completed, and it looks like it is on the way to really starting a good program for improving the water quality of the Animas and San Juan Rivers. The problem is rapidly being resolved. The ultimate development of the San Juan and the Animas depends on the quality of the water we come up with. There are some rather intensive plans for really big developments of the San Juan in New Mexico, and there will be great acreages brought under irrigation, so it behooves us to keep on our toes to keep the San Juan and the Animas clean.

One of the developments will be the construction of the Navajo Dam. That will play a tremendous role in affecting the quality of water below the dam. A basic water quality sampling station is presently being arranged for at Farmington. A chemist has been employed by the City of Farmington, who will be available to work with the PHS, so that we may have this quality sampling station there.

We are very much interested in any problems that may be developed above us. They have an important bearing on water supplies in New Mexico. We are appreciative that this conference has been called to consider the whole basin. Officially, we would be very much interested in any problems that may be developed that are in New Mexico. Certainly we want to, and will, cooperate fully with the PHS and the other States in the watershed basin, to solve any problems we may have.

MR. STEIN: Are there any comments or questions? We call the State of Utah.

MR. THATCHER: This is a joint statement of the Utah State Department of Health and the Utah Water Pollution Control Board.

The Colorado River and its tributaries present problems of increasing concern to the Utah State Department of Health and the Utah Water Pollution Control Board, not only because of the radioactive and other wastes now known to be discharged into certain of these waters, but also because of proposed developments which will result in increasing quantities of waste discharges of various types. Certain of the waters in question already have excessively high levels of dissolved sulphates, the sources of which are unknown to us at present. Some of the waters contain petroleum wastes in readily observable quantities, and there has been discussion about possible location of new waste-producing industries in various parts of the drainage basin.

Previous studies on the Animas River by the U. S. Public Health Service have brought to light the necessity for detailed attention to the question of radioactive wastes in all areas where uranium ores are or will be processed.

While we are aware that these problems exist, we do not have enough detailed information to make specific recommendations, or to draw specific conclusions regarding existence of pollution. We believe, therefore, that there is need for a detailed study, which we hope will show the exact nature and quantity of wastes entering the Colorado River and its tributaries, and the ultimate effect of these wastes on the waters. It is our belief that this study should consider all types of pollution. The effects of pollution on the water should be evaluated with the idea that this water will continue to be used for all present purposes, which include domestic use, irrigation, and various types of industrial and recreational use, at the same or expanded rates.

Due to limited facilities of the Utah State Department of Health and the Utah Water Pollution Control Board, it seems logical that the U. S. Public Health Service be requested to provide aid in the conduct of necessary studies, and it is therefore requested that this aid be made available on the scale necessary to arrive at suitable conclusions. We are particularly interested in several of the streams in the Colorado River system, including the main stem of the Colorado River, the San Juan River, the Dolores River, the Green River, the White River, although our interest is not limited to these streams.

That concludes the formal statement. May I ask Dr. Soffe if he has anything to add? Dr. Soffe is Director of Public Health in Utah, and also a member of the Water Pollution Control Board.

DR. SOFFE: I think the statement is complete.

I would like to say, like Dr. Cleere, Dr. Hurley, and Dr. Leland, that we are appreciative to the Surgeon General and the PHS for calling this conference, and are willing and anxious to cooperate in any way.

MR. STEIN: Any comments or questions? Then we shall call upon the State of Wyoming - Mr. Green.

MR. GREEN: The State of Wyoming, I believe, is in a rather unique position, even moreso than our friends from Colorado. We receive no waters from the Colorado drainage basin. However, we do have several small streams in addition to the Green River which discharge to the Colorado drainage basin.

The State of Wyoming, through its Department of Public Health and its Stream Advisory Council, has carried out at least a moderately successful water pollution abatement program. In fact, it has now reached a point where our main concern is for the prevention of future pollution, rather than abatement of existing pollution. As far back as 1957, the Stream Council has met with representatives of the AEC to discuss the possibility of studies concerning the advent of more radioactive pollution in the State. The AEC and the Stream Council are both on record as recommending an intensive water quality study. More recently, we have had to go into the possibility of a great expansion of industrial complexes in the Green River Basin. We ourselves are in no position to work out such a study as we believe is necessary, due to lack of financial support and lack of manpower. We feel, therefore, that the PHS might well consider conducting such a study, not only in the vicinity of Wyoming, but throughout the entire Colorado River Basin.

We would like to thank the Surgeon General for inviting us to this conference, and to assure the PHS of our full cooperation insofar as we are able, should they undertake such a project.

MR. STEIN: Any comments or questions? If not, we shall call on the other Federal agencies represented.

First, one word from the PHS point of view about Colorado. We really appreciate their sympathetic cooperation in all of these problems. It is very difficult, when sitting in one river basin, to understand the situation that Colorado is in. As Dr. Cleere points out, they sit on top of at least four major river basins, and people are always looking at them as the upstream state. One of the people we had stationed there for awhile got so annoyed with this that he almost became a paranoic. He developed a map of all these river basins going into Colorado, and it looked like an octopus going in and pulling the State apart. Even though Colorado does have that geographical position, and they have to pay something for having that Mile High City, they have cooperated very effectively on all of these problems.

We call at this time on the representative of the Atomic Energy Commission, Mr. Rogers.

MR. ROGERS: We appreciate the opportunity to be present at this conference. The conference is concerned with pollution of the water resources of the Colorado River Basin from all sources, and with many kinds of pollutants. The Atomic Energy Commission has a regulatory interest in potential radioactive pollution problems affecting the Colorado River Basin as related to radioactive materials discharged from installations licensed by the Atomic Energy Commission. In particular, twelve of the twenty-seven AEC licensed uranium mills are located near the Colorado River or its tributaries.

The milling process results in the production of relatively large volumes of low-level liquid wastes containing uranium, thorium and their daughter products. These wastes are usually discharged into settling ponds. Liquors from these ponds overflow into surface waterways or reach them by seepage or drainage.

The uranium mills are subject to the Commission's regulation 10 CFR 20, "Standards for Protection Against Radiation". These regulations require that concentrations of radioactivity in the mill effluent must not exceed permissible drinking water levels when it leaves the licensee's control and enters an unrestricted area, except as may be approved by the Commission. Such approvals may be granted where environmental dilution factors are such as to provide assurance that at points of use the concentrations are within permissible levels. For these reasons, we are particularly interested in any information which is developed dealing with the capacity of the Colorado River Basin to safely receive radioactive materials. This type of information will be of assistance to us in evaluating requests by mills to take advantage of demonstrated dilution factors in discharging waste and to assure that such discharges, together with other sources of radioactive materials do not result in exposure of people to excessive concentrations of radioactivity from the utilization of the water resources.

Recognizing the potential waste problem from uranium mills, the AEC in the summer of 1958 requested the U. S. Public Health Service to conduct an industrial waste investigation involving effluents from representative uranium mills in the Colorado River Basin. The PHS agreed to undertake the study, which is receiving financial support from the Commission. The purpose of the study is dual-fold: (1) obtain basic information on the sources and characteristics of wastes from representative uranium milling processes for the purpose of developing an industrial waste guide for the uranium-milling industry, and (2) relating these waste discharges to effects in the receiving stream. With these objectives, extensive field investigations have been performed at mills utilizing the acid leach-resin in pulp extraction process and acid-alkaline leach-solvent extraction process. In conjunction with this work, Johns Hopkins University collected detailed stream data on portions of the Colorado and Gunnison Rivers. We understand that all radiochemical analyses have been completed, and reports of these investigations will be made available in the near future.

It might also be worthwhile to note another cooperative project we requested the PHS to undertake. The Robert A. Taft Sanitary Engineering Center group has developed and compiled analytical methods and procedures for determining the concentrations of various radioactive materials in the environment. This compilation should also be available in the very near future.

In addition, the Commission's Process Development Laboratory at Winchester, Massachusetts, has for the past two years been engaged in research and development to reduce radiological hazards associated with milling operations. This work has resulted in improved procedures for removing radioactive materials from waste liquors. It has also produced data concerning the solubility of radioactive waste particulates in water through natural weathering. These studies are continuing. We believe all this information will assist in handling mill waste in a safe manner.

The Atomic Energy Commission is responsible for determining whether or not mills are complying with its regulations, and for taking enforcement action when necessary. Our Division of Inspection visits these mills to determine what the mill operators are doing to comply with the regulations.

The Commission has issued orders to eleven of the mills, requiring them to correct deficiencies and to take action to comply with Commission regulations. Four of the orders dealt with a failure of the mills to adequately determine the concentrations of radioactive material being discharged into the Colorado River or its tributaries, and one order dealt with a mill discharging effluents into the Animas River in concentrations in excess of those permitted by Part 20 of the license conditions.

In addition, the Division of Inspection has recently collected samples of effluents from all of the mills discharging wastes into the Colorado River and its tributaries, and has collected samples from the rivers near these mills. The results of this sampling program are now being evaluated. As a result of these Commission actions, the mills have initiated or are initiating comprehensive survey programs on radioactive effluents, and are seeking safe methods for handling waste.

The AEC will take whatever steps are necessary to assure that milling operations are conducted in compliance with the Commission's regulations and license conditions, and will not endanger public health and safety. We are anxious to work closely with interested Federal and State agencies on problems relating to our regulatory responsibility. Insofar as the over-all AEC radioactive waste disposal research and development program may play a part in the studies discussed at this conference, we would also be pleased to cooperate.

MR. STEIN: Thank you, Mr. Rogers. Are there any comments or questions?

MR. BONDERSON: Yes, I would like to ask a question or two. You state that you have regulatory authority over these mills. Do you have any kind of a monitoring program as to the characteristics and the types of wastes that are being discharged from these mills?

MR. ROGERS: There have been studies made by the mills themselves, and also by the Division of Inspection, wherein samples have been taken as to the concentration and the types of wastes being discharged. This, of course, refers only to radioactive wastes. We have no control over the chemical or toxic wastes being discharged.

MR. BONDERSON: In other words, you have no continuing program for the monitoring of these wastes?

MR. ROGERS: Do you mean the Commission itself?

MR. BONDERSON: Either the Commission itself, or at the Commission's request, by the mills.

MR. ROGERS: Yes, by the mills. The mills themselves are required to have a continuing analysis program. They must be able to demonstrate from the data they collect that the radioactivity they are discharging is within the regulations. That is the reason some of these orders were issued. We found some of the mills were not doing it.

MR. BONDERSON: Who has this information?

MR. ROGERS: It is available at the mills. We also have some data, as a result of the inspections made by the Commission. At the time of inspection the licensee's data is gone over in detail. If it does not appear to be adequate, we can do two things: (1) require them to take action to get more comprehensive survey data; or (2) we ourselves will take samples to try to determine what kind of concentration is being discharged.

MR. BONDERSON: Is this information available to the public, or to interested agencies?

MR. ROGERS: I am sure we could make it available to interested agencies.

MR. BONDERSON: But there are no formalized reports of this nature available?

MR. ROGERS: There are formalized inspection reports on file with the Commission. As far as releasing these reports, I don't believe I could say that we could at this time. I am sure, though, that arrangements can be made to make available technical data which are in the reports.

MR. STEIN: Are there any other comments or questions?

MR. GEORGE: I am D. R. George, with the AEC Division of Raw Materials, Grand Junction, Colorado. Regarding the availability of data, as Mr. Rogers has pointed out, the inspection reports are not available; however, the PHS and also the Raw Materials Laboratory at Winchester have issued a number of reports which are available, describing general characteristics and concentrations of both radioactive and chemical wastes discharged from some of the mills. Dr. Tsivoglou has made studies on several, and is continuing his work. I think this also would be available.

MR. ROGERS: As far as data being available on what individual mills are discharging in terms of radioactivity, it is either available or it is becoming available fairly rapidly, as a result of the work being done. I think the real question is the impact of all of the discharges into the river basin.

MR. STEIN: I want to thank Mr. Rogers, of the AEC. In connection with the PHS water pollution control program, we have received full and complete cooperation in all aspects of this, and we certainly could not have progressed as rapidly in our work, or have gone ahead as we have, without the full cooperation of the people at AEC.

Sometimes, as you people know, in a bureaucracy, a big bureaucracy such as we have in Washington, this is difficult, but we do have a very excellent relationship on a working level. I am sure that any of the State water pollution control agencies, or any of the State Health Departments that may have some problems, can find these readily resolved if they just pursue it and ask the right questions and enlist the aid of the AEC.

May we call on some of the other Federal agencies. If a Federal agency does not wish to make a statement, we would be happy if, for the record, the person representing the agency could identify himself, and so state. Of course, we would be happy to receive statements from these other Federal agencies. How about the Geological Survey, or the Department of the Interior?

DR. BARKER: I am Dr. Franklin Barker, Water Resources Division,

U. S. Geological Survey, Denver, Colorado. Mr. Hembree and I came to this meeting strictly as observers. We had no comments prepared. However, I would like to take this opportunity to thank the PHS for inviting us and giving us this opportunity to become a little more familiar with some of the problems facing the Colorado River Basin. I would like also to take this opportunity to mention briefly some of the data and information that we have available which may be of use to the State agencies in terms of this problem.

It is part of our responsibility to investigate and evaluate the quantity and quality of the water resources of the nation, and we have undertaken a program to try to learn a little more about the natural radioactive substances in water. We are not nearly so concerned with the artificial radioactivity and the pollution, as the PHS is. However, we are trying to evaluate a base line, so to speak. As a result of this research we have collected a number of samples within the Colorado River Basin. In the basin, most of our investigations have been on groundwater, rather than surface water.

We have, within this basin, made a pilot study on the Roaring Fork Basin, a tributary to the Colorado River in Colorado, and a slightly more extensive study in the San Juan Basin of Colorado and New Mexico. We did not undertake the study in the San Juan because of the pollution problem there; in fact, if we had realized the extent of pollution there, we would have gone somewhere else, since we are interested only in the natural radioactive pollution. However, it happened that we were working in the area at the same time as Dr. Tsivoglou was making his investigation. Ours is continuing, and our data have complemented each other, I believe. We have been quite fortunate in being able to trade information. We have a few well-scattered samples from the Colorado River drainage; one sample from Yuma, one just above Moab, and one at the mouth of the San Juan River.

These data are available to any of you who may be interested in them. They are on file at the appropriate district laboratories; that would be Salt Lake City for the western part of Colorado and Utah; at Albuquerque for Arizona and New Mexico; and, of course, in our research laboratory at Denver, where all of these determinations were made, we have the files. They are available on request.

In addition, there has been considerable chemical quality work performed in the Colorado River Basin recently, as part of the Upper Colorado River study being carried out by the Department of the Interior under Public Law 485. There have been about three hundred sites studied as far as chemical quality is concerned in the basin. (Actually, Mr. Hembree knows more about this than I do, and he should probably be talking about it.) These were studied at high flow, low flow, and medium flow, with complete chemical analyses. There are fifty sites which have been studied as far as the sediment levels are concerned. There are a number of daily sampling stations where samples are collected and composited. I do not know the locations of all of these. I know those in the San Juan Basin best, where I have been working myself. These data again are available at our district laboratories. They can be obtained by writing to the District Chemist.

MR. STEIN: Thank you, Dr. Barker. I might say again that in this aspect of the PHS work, the work of the Geological Survey has been invaluable. I don't think we could have concluded our work without relying on your data, and in many cases we had special studies done for us. We certainly appreciate it. Thank you.

May we call on the Bureau of Reclamation representative, Mr. Jacobson.

MR. JACOBSON: I, too, am here in the role of observer, rather in the role of giving a statement. The Bureau of Reclamation, however, is the principal public agency in the basin engaged in the planning and construction of large irrigation, power, and other multiple use facilities. Therefore, we are very concerned as to the quality of water presently existing, and the qualities that we can anticipate in the future in the planning and constructing of these facilities.

The Secretary of the Interior, under Public Law 485, which authorized the initiation of this construction program, is charged with continuing quality of water studies, and eventually preparing reports for submission to Congress on the quality of the water of the Colorado River. We are cooperating very closely with our sister agency, the USGS, and in our office in Salt Lake City we also have a fulltime employee of the PHS working on our project plans and studies involving the use of water, not only for irrigation, but municipal and other types of uses. Our projects are primarily irrigation and hydro power. However, a good deal of the water will be used in the basin and will be exported from the basin for industrial, municipal, and other types of uses. Recreation, of course, is also a large function which results from the construction of these reservoirs on the Colorado system.

MR. STEIN: Thank you. Are there any comments or questions? Is there a representative from the Corps of Engineers?

MR. McCOY: I am Joseph McCoy, of the Corps of Engineers, Los Angeles. I have no statement to make.

MR. STEIN: Is there a representative of the Upper Colorado River Commission? If not, is there anyone else here who wishes to make a statement or a comment?

DR. SIGLER: I would like to ask Dr. Vaughn E. Hansen, Director of the Engineering Experimental Station at the Utah State University, to make a statement, if he will.

DR. HANSEN: I, too, came as an observer, but I believe there is one element, perhaps a complementary aspect, which might well be stressed before this hearing. I would like to present for your consideration the role of the university in this type of undertaking and cooperative effort. Certainly there is a problem. I don't believe there has been a dissenting vote any place on the need and the willingness to cooperate. We endorse that attitude. We believe that the universities, and with your permission I speak generally, rather than solely from the standpoint of the Utah State University which I represent, may well fill a need here, and assist in an area which is to a degree lacking.

The universities in general do not have "an axe to grind", or cannot be accused quite as directly of having an axe to grind as some of the other groups might have. I do not mean that in a derogatory sense at all. I mean only that there are some phases which we may be able to assist you with which might be difficult, from the public relations point of view, to carry yourselves. In addition, the universities have a rather broad scope of technical specialists who are available to work with you on the problem. Most of the other groups are more or less specialized in their backgrounds, and therefore the need for cooperative effort among agencies. At the same time, some problems may well be handled either on or off the campuses by the cooperative effort of the various departments of the universities through their research agencies. Certainly there, there are individuals who are competent and able to assist not only with the water quality or water quantity problems, but also with the crop aspects, the wildlife, the algae problems, etc., and may very well work effectively as a smaller team without the difficulties of interagency cooperation that may arise in some cases; at least, with more flexibility in many areas. Also, there are laboratories which can assist in this type of activity, and the libraries which are available.

From the research standpoint also, there are some problems which cannot be fully evaluated under the variable conditions which exist in the field. The extreme variation of stream flow has been mentioned. The facts that as the floods come down, the radioactive materials in the stream bed are changed materially; in some cases they are lost somewhere downstream. Many of these effects might well be studied under more controlled conditions, to supplement -- not replace -- observations in the field, and thereby give you a control which you cannot otherwise obtain.

I would like to call attention to the need of helping the public to understand this problem more fully, and to appreciate its consequences. Sometimes agencies have difficulties in getting across the message to the public, because as soon as it comes out under your name there is the question "they have a personal interest", or "they are blowing their own horn", etc. Those things are almost always not true, but sometimes difficult, and sometimes there are even legal restrictions. The universities, through their extension activities, through their publication mediums, can also help to disseminate and coordinate this type of activity. They can help to inform the public of the need and the urgency of the problem you are facing, and certainly there is no question of the need for public support.

Likewise, the universities can assist you in the additional role of training technical personnel. This is not, as has already been stated, a short range program. It is a long range program. Invariably you are in need of technical assistants, as these programs enlarge. They certainly cannot be picked up overnight. We need to consider the program in terms of a two, five, or ten-year project. Most certainly, your assistance lent to the universities as a by-product here is not minor in its significance. Whenever research activity is undertaken on the campus, graduate and undergraduate students are exposed to field activity and to research activity they would not otherwise become acquainted with. Certainly you cannot prepare a man solely in a classroom for the job required in a public agency. Any research activity invariably involves the student, and he can be trained and indoctrinated in this type of program so that he is effective to you when he graduates. In short, it is our feeling as universities that we can complement your very desirable efforts in this regard, that there are facilities there from the standpoint of manpower, laboratories, libraries, etc., to assist in that effort, and that effort also can be directed from the universities very effectively toward the job and toward the students, in educating them to the problems you are facing.

MR. STEIN: Are there any comments or questions? Mr.Thatcher, do you have anyone else you would like to introduce?

MR. THATCHER: Mr. Norman Chamberlain, of the Utah Fish and Game Department is here. Do you have a statement, Mr. Chamberlain?

MR. CHAMBERLAIN: The Utah Department of Fish and Game is seriously concerned with the potential deleterious effects that might be imposed on the fisheries in the Glen Canyon Reservoir by any source of pollution. We are particularly concerned about radioactive wastes which might create psychological as well as biological problems. We are interested in having these problems resolved as quickly and as expeditiously as possible. The Department would like to take this opportunity to extend an offer of assistance to any agency responsible for accomplishing those results.

MR. STEIN: Thank you. Mr. Thatcher, do you have anyone else?

MR. THATCHER: Mr. Winn, of the Uranium Reduction Company, at Moab, Utah, is here. Mr. Winn, would you like to make a statement?

MR. WINN: I am B. B. Winn, of the Uranium Reduction Company, Moab, Utah. As Mr. Rogers of the AEC pointed out, the Uranium Reduction Company is operating under a license granted by the AEC, and follows the regulations as specified in Part 20, Title 10, of the Code of Federal Regulations. As the AEC's research group in Winchester and Grand Junction developed their work as to what the contaminants were, and what pollutants were discharged from uranium processing plants, the Uranium Reduction Company has taken steps to correct these problems as we became aware of them. At the present time we are working on tailings effluent evaluation and correction. We have also followed a comprehensive air pollution and inner plant contaminant study. As future research work develops the right path to take in the correction of effluent waste removal, I am sure that the interested agencies can count on our cooperation.

MR. STEIN: Thank you. Mr. Thatcher?

MR. THATCHER: One of our invitees was the Union Carbide Nuclear Company. It is my understanding that Mr. Robert G. Beverly is representing them; although he is not from the State of Utah, I believe he is answering our call for an invitee. Mr. Beverly?

MR. BEVERLY: I am Robert G. Beverly, of the Union Carbide Nuclear Company, Grand Junction, Colorado. I just want to make three main points.

First, to let everyone know that certainly the mills are very cognizant of this problem. Emphasizing Mr. Winn's statement, we operate under a license issued under the Division of Licenses and Regulations. We are doing a tremendous lot of work on sampling of our effluents, as well as their effect on any natural stream and underground water. In this connection we are, of course, doing everything possible to comply with the regulations, because without the license, we don't operate.

Secondly, one thing that I think must be realized by everyone concerned is the analytical problem involved. We are talking about micromicrocuries. We have some six zeros ahead of any figure -- six zeros behind the decimal point. A lot of the levels, particularly speaking now of radium, that we are going to find in a study of the Colorado River system, and particularly during the periods of high water, are going to be so low that it will be difficult, if not impossible, by presently known analytical techniques, to find the figure -- the difference that one mill, or a river containing a little radium going into a large river with greater dilution. The PHS as well as the AEC is doing a lot of work on analytical techniques, but I think that it is one of the most difficult analytical problems we have run into in a long time.

The third point is that we must consider, when talking about these figures at quite low levels, that the National Committee on Radiation Protection, in Handbook No. 69, has pointed out that radium may be raised by two and a half times its present level. A lot of the figures we are going to see will be in this range, and I think we should consider this, particularly in public releases, to prevent any unnecessary alarm by the public because of the fact that we are close to this boundary. Naturally, the effort is toward keeping very well below these levels, but it is a figure which is under consideration at the present time.

We also have cooperated with a number of the Federal agencies, the AEC research program, the USGS, the PHS, and certainly we will be happy to cooperate all we can.

MR. STEIN: Thank you. Mr. Thatcher?

MR. THATCHER: Mr. Tom Jensen, of the Utah Water Users Association? He was here earlier. Is there a representative of the Utah Petroleum Council? I did not get the name of that representative. Apparently not. Are there any representatives of Utah Counties in the basin? Any representatives of Utah cities located in the Colorado River Basin? Is the Mayor of Moab here? I had word he was coming, but apparently he did not make it. Are any of the wildlife associations in Utah represented? Utah Mining Association? Utah Manufacturers Association? Utah Farm Bureau Federation? Are there any representatives of the Dairy Industry in Utah? Oil industries, or gas industries? Is there someone here from Texas Zinc & Minerals Company, of Mexican Hat? Mr. Morfitt has spoken for the Indian interests. We had sent invitations to both the Ute Tribal Council and to the Navajo Tribal Council. If there are any representatives here from those groups, we would like to hear from them. I believe that completes our list, unless I have missed someone who would like to make a statement.

MR. STEIN: Thank you, Mr. Thatcher. Mr. Nasi, do you have anyone else? Dr. Leland?

DR. LELAND: If neither Mr. Lowe, Mr. Jensen, or Mr. Caldwell would like to make an additional remark, I have no one else.

MR. STEIN: Dr. Cleere?

DR. CLEERE: Colorado rests.

MR. STEIN: Mr. Green?

MR. GREEN: I would like to make one comment. I think I am probably very guilty of this, along with the rest of you, but it seems to me that the major portion of this discussion has dealt with radiological pollution. I don't mean that this has been over-emphasized; certainly, that cannot be done. But I think we have tended to play down the other types of pollution, and may have under-emphasized them. For example, the oil industry. One I do not remember being discussed was the regulation of the Colorado River and its tributaries, which very definitely has quite a bit of an effect. The third, which was mentioned but not followed up, was the natural pollution -- agricultural, erosion, etc. I would like to request that the Service give these equal consideration, along with radiological pollution.

MR. STEIN: Mr. Bonderson, do you have anyone?

MR. BONDERSON: Yes, we have some delegations here from California. Mr. Matthew, of the Colorado River Board, has had to leave. Mr. Simmons, Manager of the Palo Verde Irrigation District, has also gone. Mr. Mitchell, of the Imperial Irrigation District of the Water Pollution Control Board, would you like to make a statement?

MR. MITCHELL: As a member of the Imperial Irrigation District Board of Directors, I would like to say that we will do all we can to help, in any way. All we ask is that you do a good job, keep your budgets down, and keep that water flowing down to us pure and free of all types of pollutants! We want to keep our little share of water clean. On the other hand, as a member of the Region 7 of the Colorado River Pollution Control Board, through our State Chairman, we will do all possible to help you in anyway we can.

MR. BONDERSON: Mr. Weeks, of the Coachella Valley County Water District.

MR. WEEKS: I have no comments.

MR. BONDERSON: Mr. Ripley is here, representing the California Department of Fish and Game. Would you like to make a statement, Mr. Ripley?

MR. RIPLEY: I would like to say for the California Department of Fish and Game that we are interested specifically in the pollution of the Colorado River, both from the standpoint of recreation and from the standpoint of the effects upon the wildlife environment and the fisheries environment.

There is one aspect that I don't believe has been touched upon by this hearing today, and that is the international aspect of potentialities of the pollution problem that might exist in the Gulf. As some of you might know, a good portion of the west coast seafood products come from the Gulf -- shrimp, species of fish that are prosecuted by Arizona and California and United States fishermen in the Gulf, and many other seafood products. These would be subject to contamination by any type of pollution that would get into the upper end of the Gulf, or the Gulf itself,through biological uptake and through the concentration processes that are involved. In respect to the study that is contemplated here, I know certainly that the Department of Fish and Game is extremely interested, and would support the background and the reasons for the study, not only from the standpoint of moral support, but also from the standpoint of all the data we have available. This is entirely too voluminous to present to this meeting, but it is available, and you are most welcome to use it. Thank you.

MR. BONDERSON: Mr. Willets, representing the Department of Water Resources.

MR. WILLETS: The Department has concurred in your report, and we have no comments.

MR. BONDERSON: Have I missed anyone from California? That is all, Mr. Chairman.

MR. STEIN: Mr. Marx, do you have any additional people to call on?

MR. MARX: Well, I will see if they are here. Mr. Wayne Akin of the Boundary Commission? Mr. Harry Biggleston from the Arizona Sewage and Water Works? Tom Calhoun, Executive Secretary of the Game Protective Association? Mr. Ray Kiliett, Secretary of the Interstate Stream Commission? Mr. Polenske, of the Arizona Water Company?

MR. POLENSKE: I have no comment. We concur in what has been said.

MR. MARX: Mr. Smith, or his representative from the Game and Fish Department? Mr. Russell Switzer, of the Arizona Power Authority?

MR. STEIN: Dr. Hurley?

I think, since there is so much unanimity of opinion here, we probably can wind up, if we can just go a little longer and forego lunch. I don't know of any place near here to eat. I may be mistaken, but I think we can wind up in another fifteen or twenty minutes, unless there is a considerable amount of discussion.

The Public Health Service is in a slightly different position in coming to this conference than we have been in others, and this is because of the size of the undertaking and the magnitude of the problem. It is largely a question of degree. In other conferences involving smaller river basins, or smaller segments of a river, we have always been able to give a pretty solid commitment that we would undertake the study because funds had been budgeted in our regular appropriation. Because of the size of this one, we will have to make all of our commitments subject to the availability of funds. Any day now, perhaps today, the President will announce his budget in detail. We cannot release any information before he announces it, but I do think that we can, with that little "caveat", as we say in the law, perhaps summarize what was said here, and see if there is any discussion. I will probably try to do this both as a summary and as a means of discussion.

Everyone is agreed that the Colorado River Basin presents a water quality management problem. There may be active present pollution, or there may be a lot of potential pollution here. Particularly in an arid area of this sort, however, pollution at relatively -- and I say "relatively" -- low levels, becomes critical because water here is the limiting resource which limits population, industrial, and other growth. There are several unknowns about the situation. I do not think, for example, that the Surgeon General can, after this conference and without further information, develop a conference summary which even in a reasonably definitive manner discusses the occurrence of pollution of interstate waters, adequacy of measures taken toward the abatement of the pollution, and the nature of delays, if any, being encountered in abatement of that pollution. It seems that a cooperative Federal-State study is indicated. Such study, of course, will have to be developed in its many technical aspects, because of the complexity of the problem.

I think the pattern of operation of the Public Health Service is very clear. You can be assured that if we undertake such a study, the prospectus of the study and its details will be discussed very thoroughly with all State agencies represented here, and the other Federal agencies. I think we can indicate from at least the Public Health Service point of view that we would not like to get into aspects of the study which would duplicate any other Federal agency's operations. We want this to fit into the total resources picture here, and try to complement the other Federal agencies; and certainly, that is our attitude toward the State agencies.

Since this will involve such large sums of money, I think that we in the Public Health Service believe that we have enough of a job to do that we have to work at this cooperatively, and try to get as much help as we can from as many strengthened State and Federal water pollution control agencies as we possibly can. Briefly, this study would cover several points:

1. There would have to be a careful basin analysis describing the sources of pollution, present and future. In all these things I think we are talking about pin-pointing them and delineating them as clearly as we possibly can.

2. The second thing I think we have to do is make a very careful evaluation of water uses in the basin. In this basin there does not seem to be too much clear data as to water uses, particularly judgments as to future water uses.

3. The next thing we have to cover in the study is to analyze the sanitary quality of the waters of the basin; and you people who have been in this job know that this is a tremendous job, said very rapidly.

4. The next thing we have to consider is the evaluation of the effects of all the water uses on this sanitary quality. I think Mr. Dave Green made a remark which put this in perspective, and that is, our statutory obligation is to consider all sources of pollution, and the total water quality management operation.

From the point of view of the Federal Water Pollution Control program, we regard radioactive wastes as another pollutant. The emphasis here has been because radioactive wastes are causing, and understandably so, the most immediate concern in the basin, and this may be an area where we have, sketchy as they are, more information and more figures than we have in some of the other aspects. I think it is pretty clear that the studies will cover domestic wastes and municipal wastes, the wastes resulting from the use of the timber resources of the basin, wastes from the coal and oil shale deposit developments, wastes from food processing industries and similar industries, deterioration of water quality by agricultural uses and erosion, pollution caused by toxic and chemical materials, and pollution caused by radioactive wastes. I think we may even throw in a catch phrase, and say it will be pollution caused by any industrial wastes in the area, as well as the natural.

I think the consensus is that the report should be directed toward trying to see if we can give the maximum water quality to the multiplicity of water users in the basin; and that is, of course, domestic, industrial, agricultural, fish and wildlife, recreation, hydroelectric development, and last but perhaps most important, protection of the public health.

I think we have certain indications of the scope of certain of the pollution problems. For example, where some of the more critical radioactive pollution areas may be located, and where some of the more critical pollution problems from other types of wastes may be located, perhaps industrial or domestic wastes.

It seems to be indicated that after the study has been developed, a system of priorities will be established so that we can try to get at the most pressing problems first; and not just wait until the study is completed. I would like to point out that most of the discussions seem to be directed toward this as being what we bureaucrats sometimes refer to as an "action program"; that is, it is going to be in the pattern of the Animas River action. We are not just going to engage in a study, and file that study on a shelf. When a source of pollution is discovered to be interfering with the water use, and the conferees agree that remedial action should be taking place, we will try to develop such remedial action and set a time schedule for such remedial action.

The report will also have to determine the specific pollutants and the concentration of the pollution, and include radioactive, chemical and biological, microbiological studies, and I assume in many cases, the usual studies we regard in water pollution control work, oxygen analysis and coliform tests and pathogen tests, etc. Again we will have to work very closely with the Bureau of Reclamation on this problem of agricultural waste waters and the growing problem that we hear about all the time of fertilizers and insecticides. We will probably have to include in this report, or consider including it, a physical engineering survey of the existing waste treatment facilities you have in the basin.

I think we have a pattern in the Public Health Service for a survey somewhat analagous to this, and that is the survey now being carried out on the Arkansas-Red River Basin. The headquarters for that operation is in our Dallas office. Mr. Jerome Svore is here, and he is very familiar with the pattern of operation we have there. The Public Health Service has received a budget for that, and has set up headquarters and office facilities in the Dallas office and is working very closely with the States and the other Federal agencies.

I do not want to speak too much here about the technical aspects of the study, because I probably will be getting beyond my depth, but I do think we are going to have to set up a plan of operation, and because of the varied nature of this operation, a sampling and surveying team. At least the radiological aspects and certain of the other toxic aspects have to have considerable analytical laboratory work done. After the laboratory analyses are completed, the State and Federal people will evaluate what we have, and we should probably be able to come up with a report and possibly have another conference.

I would suggest, in order to give us a time schedule and not let us run off -- and maybe we will want to hear from Ernie on this -- if we are not going to get off the ground, we may as well know this after a certain amount of time, and set this down. One of the defects we have in setting a time schedule is to let these problems drift on year after year. I would suggest that we consider holding a second session of the conference perhaps a year from this time, or perhaps no longer than fifteen months from the time of this conference. At that time we would expect the Public Health Service and possibly the other agencies concerned to come up with a progress report of where we are, or what is being done, so we can evaluate our problems and try to see where we are going. I do not know whether that would be too short a time for us to come up with any determinations of remedial measures, or whether we will have pinpointed any areas of pollution, but I am suggesting this as a reasonable time, so we don't put this off too far in the future. The first year we go into this will be the slowest, because there will necessarily have to be a build-up of facilities and staff. After the first year or so there may be considerable acceleration.

Are there any questions or comments?

DR. HURLEY: Mr. Chairman, as long as you are setting a date, I would like to issue an invitation to hold the second session of the conference in Las Vegas.

MR. STEIN: I was suggesting a date, and I think this is a very excellent suggestion. As I look at this, this will probably go long enough in development of the data on this program that we possibly should think in terms of rotating the conference among the several States concerned. But I wondered what you would think of this proposal.

DR. CLEERE: I think it is a good proposal, Mr. Chairman, but is it possible for the Public Health Service to commence the study immediately, or will it be necessary for them to present a budget to Congress?

MR. STEIN: I can answer that question very directly. The President presents all budgets to Congress. Without the budget being presented to the Congress and the Congress appropriating funds, we will not be able to commence this study. This study will take additional financing and budgeting in this regard. I would like to call your attention, though, to the fact that the Secretary of Health, Education, and Welfare, Mr. Flemming, had a press conference this Tuesday where he announced the holding of this conference. Mr. Flemming indicated that he was very favorable toward the concept of a conference, and any recommendations the conference may make. Now just as a lowly bureaucrat way down on the pyramid, I generally take it that Mr. Flemming is speaking for the Administration.

DR. LELAND: Of course, first we should like to know if sufficient money has been requested for the beginning of this rather large task. Considering that this is so, this conference method has been tried now over the past three years. That is, first a conference such as this one, to outline the problem, the steps to be taken; and secondly, a report of progress and need of further progression. Thus I feel, having experienced this situation in the last three years, that we should continue this already tried and proven method.

MR. STEIN: I know the Federal agency representatives here will appreciate this. We will, I think, be able to give you more precise information on the budget as soon as we get word that the President has submitted this year's budget to the Congress. I think the time schedule calls for that to come within the next few days, if it is not occurring today. I have been away from Washington, and don't know when they scheduled that to come, but that information will be made available to you very, very shortly.

MR. BONDERSON: What you propose, Mr. Chairman, sounds very good from our viewpoints. I have one minor item, that may be a matter of semantics. That is, in your outline of the idea, you make reference to the sanitary evaluation of water quality. The sanitary evaluation of water quality, in some people's minds, has a very narrow connotation, and I think it might be well if we would consider just water quality evaluation, and not the narrower connotation "sanitary".

MR. STEIN: I fully agree with that, and it is certainly accepted from our point of view. We sometimes fall back into the old pattern of the jargon.

Are there any other comments to be had from the conferees, or does anyone from the floor want to make a comment or have anything to say?

Before we close, I want to indicate that we have a roster at the table at our right, and if anyone has not signed that, we would appreciate that you do sign it.

We will get out a summary of what was decided here at this conference, very shortly, and this will be mailed to the State agencies. The people from the States might wish to get in touch with them, because the State agencies will be in charge of distributing the summary.

Somewhat later, depending on facilities and stenographic services, we will have a verbatim transcript of the conference which also will be made available to the State agencies and the people in the States may wish to get in touch with them. As for the Federal agencies, we have a distribution system of these summaries and reports which has proved effective in the past, and we will disseminate them in that way.

Does anyone have anything they want to add, or say, before we adjourn? If not, the conference stands adjourned. I would like to thank all of you for coming and participating.

APPENDIX A

ATTENDANCE ROSTER

Conference on Pollution of the Interstate Waters
Of the Colorado River and its Tributaries
January 13, 1960

Ben Avery	Arizona Republic, Phoenix, Arizona
Dr. Franklin B. Barker	U. S. Geological Survey, Water Resources Division, Denver, Colorado
Robert G. Beverly	Union Carbide Nuclear Company, Grand Junction, Colorado
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TRANSCRIPT OF CONFERENCE

Conference on Pollution of the Interstate Waters
of the
Colorado River and its Tributaries, Second Session

Called by the Surgeon General, Public Health Service,
Under Section 8 of Public Law 84-660

The Public Health Service, U. S. Dept. of Health, Education, and Welfare,
And the State Water Pollution Control Agencies of
Arizona - California - Colorado - Nevada -
New Mexico - Utah - Wyoming

Las Vegas, Nevada

May 11, 1961

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Conference on Pollution of the Interstate Waters of the Colorado River and its Tributaries, Second Session

Stardust Auditorium
Las Vegas, Nevada
May 11, 1961

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Washington, D. C.

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Director, Division of Sanitary Engineering
State Department of Health
Phoenix, Arizona

Mr. Paul R. Bonderson, Executive Director
California State Water Pollution Control Board
Sacramento, California

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Colorado State Department of Public Health
Denver, Colorado

Mr. Wallace W. White
Director, Bureau of Environmental Health
Nevada State Department of Health
Reno, Nevada

Mr. Charles G. Caldwell
Director, Environmental Sanitation Services
New Mexico Department of Public Health
Santa Fe, New Mexico

Mr. Lynn M. Thatcher, Executive Secretary
Utah Water Pollution Control Board
Salt Lake City, Utah

Conferees: (Continued)

Mr. Frank E. Long
President, Wyoming Stream Pollution Control Advisory Council
Buffalo, Wyoming

- - - - - - - - - - - - - -

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Mr. David B. Willets
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Los Angeles, California

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Arizona Water Company:

Mr. Carl Schmidt
General Manager
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Texas Zinc Minerals Corporation:

Mr. Travis H. Redman
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Union Carbide Nuclear Company:

Mr. Robert Beverly
Grand Junction, Colorado

Uranium Reduction Company:

Mr. T. H. Izzo
Moab, Utah

(A complete Attendance Roster is attached, as Appendix B)

The Conference met, pursuant to notice, at 9:30 A.M., May 11, 1961, in the Stardust Auditorium, Las Vegas, Nevada, Mr. Murray Stein, Chairman, presiding.

MR. STEIN: The Conference is open.

This Second Session of the Conference on Pollution of the Interstate Waters of the Colorado River and its Tributaries, involving the States of Arizona, California, Colorado, Nevada, New Mexico, Utah, and Wyoming, is being held under the provisions of the Federal Water Pollution Control Act. Under Section 8 of that Act, pollution of interstate waters which endangers the health or welfare of persons in a State other than that in which the pollution occurs, shall be subject to abatement.

The first step in this procedure is the calling of a Conference. The purpose of the Conference is to bring together the States and the Public Health Service to lay a basis for future action, and to give the States and localities an opportunity to take remedial action which may be indicated under State and local law. The Conference technique, we have found in many cases, is a very useful one in getting the States and the Federal Government together and moving forward on a large segment of a river basin to get remedial and corrective action initiated.

This Conference on the Colorado River, as you can tell by the representation at the table, is the largest which was ever attempted. This is the Second Session of this Conference. The First Session was held in Phoenix, Arizona, on January 13, 1960.

The Conference includes the entire main stem of the Colorado River, approximately 1,400 miles, and its 60 tributaries. At the First Session of the Conference, the Conferees evolved certain conclusions. The first was that the Colorado River and its tributaries are interstate streams within the meaning of the Federal Water Pollution Control Act. The Conferees at that time determined that it was too early to attempt to outline with any degree of specificity the kind of thing we are charged by law with determining at a Conference. I think we should keep these things in mind, because the Conference will be directed toward arriving at recommendations and conclusions, and descriptions of these. The first is the occurrence of pollution of interstate waters subject to abatement. The second is the adequacy of measures taken toward abatement of this pollution, and the third is the nature of delays, if any, being encountered in abating the pollution.

The material presented at the First Session indicated that further study was necessary to define the types of interstate pollution problems which might exist in the interstate waters of the Colorado River and its tributaries. The investigations, as indicated at the First Session, were to include the following -- and you can see the complex nature of this by the list of things to be covered:

1. Domestic and municipal wastes;
2. Wastes resulting from the harvesting and processing of the timber resources;
3. Wastes from projected coal and oil shale deposit developments;
4. Industrial wastes, including wastes from food processing and similar industries;
5. Deterioration of water quality by agricultural uses, including fertilizers and insecticides, and erosion;
6. Pollution caused by other toxic and chemical materials; and
7. Pollution caused by radioactive wastes.

The Conferees at the First Session decided that the study should include the determination of specific pollutants and their concentration; radioactive, chemical, biological, and micro-biological studies; and a physical engineering analysis of the existing waste treatment facilities of the Basin and their effectiveness. The investigation is also going to be directed toward methods of securing the best possible water quality for multiple water use, including domestic, industrial,agricultural, fish and wildlife, recreation, hydroelectric development, and the protection of public health.

The initial stages of the study and investigation were to be directed to determining the most critical and pressing problems, in order that priorities could be established for developing data and securing needed remedial action of such problems.

The Public Health Service, in cooperation with the States, agreed to undertake this study and investigation, and at the First Session of the Conference,agreed to present the detailed proposed plan of this study and investigation to the States and Federal agencies concerned, for their review and comment. This Second Session of the Conference will outline what we have done since the First Session a year ago.

I think that in view of the magnitude of the problem, we have made tremendous progress. It is estimated that the study will take about six years, and I think that is a very reasonable time limit, in view of the scope of the problem. Particularly in this area, where we have considerable water shortages, and where we have the limiting factor of population and industrial growth, it is more and more important to have some system whereby we can achieve a regulation of the water quality, or what we would call water quality management. I think in an arid or semi-arid area particularly, but even in the humid east, the regulation of water quality is going to, and has become as important as the regulation of the quantities of the streams -- storing water and discharging it at the proper time. I don't think we can have one without the other.

We have received an appropriation for this work, and have begun. The Federal appropriation amounts to more than $400,000 a year for this Project. We are budgeted for that amount for the next fiscal year. Our appropriation bill comes before the House, I understand, next week. So far, we have heard no adverse reports, and this does not seem to be a controversial item. All representatives in the Congress seem to think that this is a pretty good notion, so we are proceeding, and you will hear from the representatives of the Public Health Service the progress which has been made during the first year.

I should like to point out that under the law this is a Conference between the Public Health Service and the States concerned. The way we have found to be most effective in presenting the material is that the Public Health Service will be called on to make a statement. Other Federal agencies will also be called on to make statements, and so will the States. At the conclusion of each statement, the other Conferees will be given an opportunity to ask questions or to make comments. At the conclusion of that, we will have a general discussion and then try to summarize and find out where we are going from here. We have to remember that this is the Second Session of the Conference. We can probably be looking toward a Third Session in the next year. We are taking a verbatim transcript of what is said. Mrs. Mary Stogsdill is making the transcript. This transcript, as well as the summary report, will be made available to the official State water pollution control agencies at the Conference. Any others who want copies of the summary report or the transcript should get in touch with their respective State water pollution control agencies, and they will make copies available to you.

At this point, I would like to call on all the States represented at this table, and ask them to introduce themselves. We will start with Arizona.

MR. MARX: Mr. Chairman, I wonder if it would be appropriate here to introduce the other representatives from the State of Arizona, and the other States as we go down the line?

MR. STEIN: Yes, that will be fine.

MR. MARX: I am George Marx, Director of the Division of Sanitary Engineering, Arizona State Department of Health. We have with us today the Honorable Senator Morrow, from our Arizona Legislature. We have Mr. Jules Klagge, Director of the Arizona Legislative Council, and his assistant, Mr. Gutterman. We have Mr. Yoder, representing the

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Arizona Game and Fish Commission, and Mr. Carl Schmidt, General Manager of the Arizona Water Company. Thank you.

MR. BONDERSON: I am Paul Bonderson, Executive Officer of the California Water Pollution Control Board. I am not sure who is here from California. I will start with a few. We have with us Mr. Seth Gordon, who is a member of the President's Water Pollution Control Advisory Board -- I would like to introduce him first. We have Mr. E. F. Bevens. He is from Blythe, a member of the Colorado Regional Basin Water Pollution Control Board, a State agency in the Imperial area. We also have Mr. Dave Willets, representing the Department of Water Resources, from Los Angeles; and Dr. Pearson, representing the Metropolitan Water District of Southern California. I wonder if the others from California could introduce themselves? I thought we had a couple more.

MR. MARX: I neglected to ask if there is anybody else here from Arizona who would wish to introduce himself? (No response)

MR. GAHR: I am Bill Gahr, Chief Engineer of the Colorado State Department of Health, Denver, Colorado. I would like to introduce the two persons present who are here from Colorado. We invited several others, but apparently they have been unable to come. We have Mr. Robert Beverly, of Union Carbide Nuclear Company, Grand Junction, Colorado; and also Mr. D'Arcy George, of the Atomic Energy Commission at Grand Junction, Colorado. Is there anyone else from Colorado in attendance at this time?

MR. NASI: Mr. Chairman, I am Kaarlo Nasi, Regional Program Director of Water Supply and Pollution Control, U. S. Public Health Service, Region VIII, in Denver. We have a large number of Federal participants, but I will introduce them later. As indicated in the agenda, they will be recognized, and some of them will make statements at that time.

At this time, Mr. Chairman, I would like to recognize some of the Public Health Service people who are here. First, as you know, the Colorado River Basin overlaps three Department of Health, Education, and Welfare Regions. Therefore, associated with me in the water supply and pollution control activities relating to the Project are two other Regional Program Directors: Mr. Jerome Svore, of the Region VII office in Dallas; and Mr. Paul Eastman, of the Region IX office in San Francisco. We are also privileged to have Mr. Russell Hart, the Regional Engineer, and Mr. Charles Wright, both of the San Francisco Regional Office.

The Colorado Project is assisted technically in considerable part by experts from the PHS Taft Sanitary Engineering Center in Cincinnati, and we have from Cincinnati Mr. Frank DeMartini, Chief of the Field Operations Section, Technical Services Branch, Water Supply and Pollution

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Control; and Mr. F. W. Kittrell, who is in charge of pollution evaluation for water supply and pollution control. It seems that every time I introduce Mr. Detmer, I introduce him last. He certainly should be introduced first. Mr. Detmer is Regional Attorney for the Department of Health, Education, and Welfare in Denver. There are other introductions, Mr. Chairman, which will be made later.

MR. WHITE: I'm Wally White, Nevada Department of Health. I have a number of my staff here: Mr. Zink, of the Las Vegas office; Mr. Crisci, Mr. Kagan, and Dr. Gould from the City of Henderson. Are there any others here from Nevada? I had rather expected some Reclamation people.

MR. RODNER: I am Jack Rodner, Regional Supervisor of Irrigation, Bureau of Reclamation Region 3, Boulder City, Nevada.

MR. WHITE: Thank you. Is there anyone here from the Park Service?

MR. CALDWELL: Mr. Chairman, I am Charlie Caldwell, Director of Environmental Sanitation Services, Santa Fe, New Mexico, and I have with me one of my strong right arms, Mr. John Hernandez, who works primarily on water pollution control.

MR. THATCHER: I am Lynn Thatcher, Executive Secretary of the Utah Water Pollution Control Board. The Chairman of our Board, Dr. William Sigler, of Utah State University, is here. Since Bob Beverly has already been introduced, I should mention he was also one of our invitees. We are not trying to get him away from you, Bill. I should also like to introduce Mr. Travis Redman, of Texas Zinc Minerals, who is with Bob. The State of Utah had a number of invitees. I am not sure how many of them are here. We will give them all an opportunity to be heard later, so I think I will not take any more time now.

MR. LONG: I am Frank E. Long, of Buffalo, Wyoming. I am President of the Wyoming Stream Pollution Control Advisory Council, and also a member of the President's Water Pollution Control Advisory Board. While Seth Gordon has been introduced, we have with us another member of the President's Board, John Samson, of Omaha.

MR. SAMSON: Thank you, Mr. Long. Thank you.

MR. LONG: I had to introduce John because we have no other residents of Wyoming here. They all love Wyoming so much they hate to leave!

MR. STEIN: Thank you, Mr. Long. I think we should note here

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that one of the Conferees is a member of the President's Water Pollution Control Board -- Mr. Long. In addition, we have two others with us, as has been noted -- Mr. Samson and Mr. Gordon. I think this indicates, in a way, the seriousness of the problem. I know that certainly in the Public Health Service we are mindful of the seriousness of this problem,and the charge we have here; because in the water quality business we believe that based on what we do here, the conclusions we reach, and the direction we take may very well lie the future of this region. While this is necessarily a very, very complex kind of case, because so many States are involved and we are dealing with a large river basin, we ask your indulgence. We ask for all your comments, so that we may carefully consider them and arrive at an adjustment of views and go ahead and see what we can do to improve and preserve the quality of the waters of this river for a multiplicity of uses.

Before we start with the presentations, there are also two other people here from headquarters in Washington. First, there is Mr. John Barnhill, Program Advisor for the Division of Water Supply and Pollution Control. Next is Mr. James Coulter, who is Assistant Chief of the Technical Services Branch of the Division.

We will now call on the Public Health Service for its presentation. Mr. Nasi.

MR. NASI: Thank you, Mr. Chairman.

As you have stated, the Public Health Service was asked by the State Conferees at the First Session in January 1960 to undertake, in cooperation with the State water pollution control agencies and other Federal agencies, an extensive interstate pollution control study of the Colorado River Basin. Funds for this work were appropriated by the Congress, and the Public Health Service, following a planning meeting in June of 1960 with the States here represented, established on July 1, 1960, the Colorado River Basin Water Quality Control Project.

Today, we should like to present to the Conference a progress report on the Project activities and findings, and to outline briefly the future plans. As you will note by the agenda, we propose to have this activity reported on by several separate reports. I should like to ask Mr. Charles Sponagle, Project Director, to lead this discussion, and he, in turn, will introduce the other speakers. Mr. Sponagle.

MR. STEIN: Mr. Sponagle, will you come to the lectern; and will all the others who make statements please come to the lectern when they make their statements.

MR. SPONAGLE: Thank you, Mr. Nasi.

This portion of the Conference program will be devoted to a consideration of Project progress since the beginning of activities on July 1, 1960, and planned future studies as indicated by present findings. I will briefly discuss existing Project staffing levels, present status of the Project Laboratory, and review generally the principal field investigations to date. The subsequent speakers will present details of the radiological and biological findings of our completed field studies, and activities under way in the development of a comprehensive water quality plan. The present status of the Project Laboratory activities and future work planned for the laboratory will then be presented. The key features of the Project report will then be summarized by the Public Health Service Conferee.

During the planning stages of the Project, a total staff of 43 people was proposed. This staff was to consist of a sanitary engineering component to be located at Project Headquarters in Denver, Colorado, consisting of 21 members; and a technical laboratory component to be located in Salt Lake City, Utah, consisting of 22 members. Implementation of this staffing pattern was undertaken with commencement of the Project on July 1, 1960. At the present time there are 14 people on duty with Project Headquarters in Denver, and 9 at the Project Laboratory in Salt Lake City. Recruitment activities are continuing, in order to fully staff the Project as soon as possible.

Immediately upon initiation of the Project an investigation was made relative to availability of space in Salt Lake City for the Project Laboratory. At that time no government-owned space was available, and bids were solicited for rental space. During the time allotted for submission of bids, government-owned space became available in a building located at 1750 South Redwood Road, and it was decided to house the Project Laboratory at this location. As of the present moment, construction is proceeding in connection with the necessary remodeling work in this building.

In view of the two principal objectives of the Project, the organizational pattern at Project Headquarters has naturally fallen into two fairly well defined units; first, a section whose objective is to plan and conduct the work associated with the field investigations of water pollution; and secondly, a section devoted to the development of the comprehensive plan for maintenance of satisfactory water quality for all legitimate water uses in the Basin. As might be expected, in practice the work of these sections is mutually complementary, the findings of the field investigations unit being integrated into the comprehensive planning work, and in many cases the requirements for data in the comprehensive planning unit leading naturally to the conduct of field investigations.

The Project Laboratory is responsible for the sanitary analysis of all samples collected. This includes a wide variety of types of samples -- water, sediments, soils, crops, and such others as may become necessary during Project operations. Due to the range of analyses desired, the Laboratory has been organized in four principal sections to provide for radiological analyses, biological and bacteriological work, inorganic chemical analyses, and organic chemical analyses.

At the June 1960 meeting in the Denver Regional Office of the Public Health Service, plans were outlined for initial field investigations to be undertaken. These plans were finalized during July, and the necessary equipment and personnel assembled for the conduct of the surveys contemplated.

Our survey work this year has been directed principally toward the radioactive pollution aspects. This phase of our total investigations was selected to receive immediate attention for two principal reasons. First, because the uranium milling industry probably represents the most significant industrial waste problem in the Basin; and secondly, because our knowledge concerning needed investigations in this area was sufficiently developed to permit the immediate undertaking of the required field work. Several types of surveys were carried out, the general descriptive features of which I will now briefly discuss.

One of our first endeavors was to conduct two-week surveys in the areas of three uranium mills. The purpose of these was to assess the effects of mill discharges on waters and the associated environment in these areas, and to determine the existing degree of water pollution. If significant pollution of either a radiological or chemical nature were disclosed, we planned to conduct follow-up surveys of a more intensive nature. The surveys in the three areas were carried out at the same time -- from August 17 to August 28, 1960. A total of 11 technical personnel participated in the field work involved, four of whom were from the Project staff, while the remaining seven were from the staffs of the R. A. Taft Sanitary Engineering Center of the Public Health Service, and Regions VII and VIII.

(1) Two engineers were assigned to work in the area of Moab, Utah. The Uranium Reduction Company of America mill is located at Moab, on the main stem of the Colorado River. Samples of river water were collected above and below the mill, and an effluent sample was obtained of the lagoon discharge to the river. The samples collected were composited over two cycles, the first cycle being of five days' duration, and the second being seven days. Once during each cycle a sample of river sediment was collected at each station. There were five sampling stations on the main stem of the Colorado, and one station on the Dolores River at the mouth, the Dolores River entering the Colorado above Moab.

(2) Two engineers were assigned to the Grand Junction, Colorado area, where the Climax Uranium Company mill is located. Samples of river waters and the sediments were collected analogously to the Moab study. Five sampling stations were established, one above and three below the mill on the main stem of the Colorado, one in a shallow channel adjacent to a lagoon which receives the mill wastes, and one a short distance upstream on the Gunnison River above its confluence with the Colorado. At this mill there is no direct discharge of wastes to the river. All mill wastes are discharged to a large lagoon. Any effects of the mill wastes on river water would occur by means of seepage from the lagoon into the above-mentioned channel.

(3) A team consisting of two engineers and two biologists was assigned to work on the San Miguel-Dolores Rivers in Colorado, the San Miguel being a tributary of the Dolores. The Union Carbide Company uranium mill is located on the San Miguel River about six miles above its confluence with the Dolores, while at Slick Rock, Colorado, a Union Carbine Company upgrading plant is in operation about 40 miles above the confluence of the two streams. At Uravan, samples of San Miguel River water were collected above and below the mill. There are three mill waste effluents discharging into the river here from lagoons, together with one seep from the mill area. Samples of all of these discharges were obtained. At Slick Rock, the Dolores River was sampled above and below the mill. A sample was also collected of drainage water from a mine which was discharging to the river. There is no direct waste discharge to the river from this plant, the liquors seeping to the river from a tailings pond. Samples were collected of this seepage. Samples were also collected on both the San Miguel and Dolores Rivers just above their confluence, and two additional sampling stations were established below the confluence. The samples were composited into two cycles, as for the other studies, and river sediments were collected in a similar manner.

In all of these studies, samples of each mill effluent were obtained for bioassay investigations. In addition, a biopopulation study was made on the Dolores-San Miguel Rivers.

All water samples were filtered as quickly as possible after collection. Through the cooperation of the City of Grand Junction, space was made available to the Project chemist in the city water plant laboratory to carry out this work. The samples were filtered through a millipore filter and shipped to the Salt Lake City laboratory.

In each of these two-week surveys, water uses downstream of the mills were determined, and samples of crops grown using the river water for irrigation were collected. Samples of soils were also collected during these studies.

A second major field undertaking in connection with radioactive investigations was a river sediment survey over the entire Basin. The purpose of this was to determine in relation to the radioactive content of the flowing water: (1) the radioactivity burden of sediments; (2) the distribution of such radioactivity over the Basin; and (3) the effects of river hydrology on this distribution. Our initial plans contemplated three sampling periods in connection with this survey: one at the end of August 1960; another in early spring 1961, before the spring floods; and a third in the summer of 1961 following the spring floods. The first sample collection for this study was carried out during the period August 8-24, 1960. Samples were collected at 73 points throughout the Basin. At many of those points a relatively shallow section of fast-flowing water would be followed by a pool. In these instances, samples were taken in both the riffle and the pool, so as to determine average conditions in this area. The second round of sample collection was carried out during March of this year, and the samples are presently being processed.

In the collection of samples from Lake Havasu and Imperial Reservoir, the National Park Service offices at Boulder City, Nevada, and the Fish and Wildlife Service offices at Parker and Yuma, Arizona were of considerable assistance to the field crew. These offices provided our crew with the use of their boats and sample collecting apparatus, and personnel of these agencies assisted in the collection of samples from these lakes.

We expect that the third collection of samples will occur sometime this summer, in accordance with the schedule set up for this study.

We have also been able to collect samples of sediments and waters at a number of points on Lake Mead, through the assistance of the Bureau of Reclamation offices at Boulder City, Nevada. At their invitation, one of our engineers accompanied the Bureau's sampling crew in their annual collection of sediments on the lake during October 1960. The Bureau's launch and sampling equipment were made available for this purpose, and their personnel assisted our engineer in collecting the samples desired.

During August 1960, a biopopulation study was carried out on the Animas River from Durango, Colorado to Aztec, New Mexico. The purpose of this was to compare bottom fauna collections with those previously made in 1958-59, and to evaluate the effectiveness from the biological standpoint of pollution abatement measures instituted by the Vanadium Corporation of America mill at Durango in 1959.

In the fall of 1960, an accidental spill of mill wastes occurred at the Kerr-McGee Uranium Mill at Shiprock, New Mexico. These highly acid wastes were impounded in a lagoon located on mill property. A wall of the lagoon unexpectedly broke, and the wastes were discharged as a "slug" into the San Juan River. Shortly after this incident, the New Mexico

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State Department of Public Health requested us to carry out a study in this area to assess the effects of the mill on the river. This study was made in November 1960, and consisted of river sampling, collection of seeps entering the river from the mill area, and bottom fauna collection from the riverbed. There is ordinarily no direct discharge of mill wastes to the river from this plant, all wastes being impounded in a series of lagoons constructed for this purpose. Samples of each seep were collected for bioassay.

The radiological analyses performed on the water, river sediment, crop and soil samples collected during the above surveys consisted of gross alpha, gross beta, and radium and uranium determinations. The gross counts were performed, for the most part, at the Public Health Service laboratory in Cincinnati. Some were done at the Project Laboratory in Salt Lake City.

It was originally anticipated that the Project Laboratory would be established and in operation during the latter part of 1960, and that all of the radium analyses would be carried out there. It became apparent, however, that serious delays were being encountered in the establishment of the laboratory and it would not be operational until, at the earliest, some time during the summer of 1961. In order to have the radium analyses of the samples already collected finished in time to report at this Conference, it was decided to ship the bulk of the samples on hand to a private laboratory. Arrangements were therefore made to send some 300 samples to this private laboratory. Results of the radium analyses performed have been received during March and April, the last set of results being received approximately the middle of April. Chemical analyses were performed on the samples collected by the Public Health Service laboratory in Cincinnati, Ohio.

Preparation of reports on the previously mentioned studies has proceeded in accordance with availability of laboratory results. However, due to the short time intervening between completion of the analyses and this Conference, it has not been possible to have these reports ready for distribution at this time. We expect to have them completed in the near future.

The delays encountered in establishing the Project Laboratory have had a serious effect on the progress of our investigative work. This is true not only in the matter of completion of reports, but also in planning our future work, since, as previously indicated, the results of the early studies were to serve as an indication of the necessity for future intensive work in the study areas, and the scheduling of work in other areas where investigations are felt to be needed.

A major undertaking planned for the early phases of the Project was the establishment of a radioactive monitoring network over the Basin. This was to consist of some 25 to 30 water sampling stations along the main stem of the Colorado River and on its tributaries from the farthest upstream State of Wyoming to the Mexican border. Its purpose is to assay the radiological content of river water over the entire Basin on a continuous basis. This network was originally proposed by the States of Arizona, Colorado, New Mexico, and Utah, at the 1957 meeting on the pollutional effects of the uranium milling industry, held at Cortez, Colorado. A field reconnaissance was made in August 1960 to tentatively select the most suitable locations for stations for this network. The establishment of this network has been delayed due to a combinationof circumstances, among which have been the extent of the work with which we have been involved this year, the lack of staff to concentrate on this operation, and certain problems with relation to the physical installation and operation of such stations which have had to be considered. We have now developed automatic sampling equipment which is considered suitable for use in this network. This equipment is presently being assembled, and we expect that field work will begin in connection with the establishment of this sampling system in the near future. Here again, we have felt the lack of a laboratory, since when this network is established, we will be collecting on a routine basis some 30 samples per month for radiological analyses.

I may mention briefly at this point another study which we are now planning, relating to the chemical water quality of the river. In March of this year, we learned from the Public Health Service Water Quality Data Branch at the Sanitary Engineering Center, Cincinnati, that the samples collected at their water quality network station at Yuma, Arizona,indicated a sudden and sharp increase in the chloride content of the river water, from a level of some 200 to 300 parts per million, to some 700 to 800 parts per million. As a result of this, the city of Yuma has had to abandon the river as the sole source of its water supply. This situation was discussed with the State Sanitary Engineer of Arizona, and some water samples were collected at several places in this area by Project personnel who were in the Yuma area completing the second round of the sediment survey. The samples were collected over a four-day period, and are presently in the Basic Data Service Laboratory of the PHS in Cincinnati for analysis. These analyses have not as yet been completed. Since these results, when obtained, will be of a preliminary nature, due to the short sampling time involved and the few stations at which samples were collected, we are now planning to carry out a more detailed study in the immediate future relative to the causes of the deterioration of water quality in this area. We will also undertake a detailed investigation of the economic effects of this situation on the city of Yuma.

The second major objective of the Project is the development of a comprehensive plan for maintenance of satisfactory water quality for all legitimate water uses. Work in this connection began shortly after the initiation of the Project, and progress in this phase of our activities

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has been directed principally toward the collection of basic data concerning waste discharges and water uses in the Basin, and such other pertinent basic data and information as is presently available. Planning for studies of the present and potential economic conditions in the Basin has also proceeded. Details concerning this work will be discussed later on during the Conference.

This concludes my summary of the major aspects of progress since last July 1. The following speakers will now present detailed discussions of the findings and Project activities in each of the areas already mentioned.

MR. STEIN: Before you introduce your other speakers, let's see if we have any questions or comments here.

MR. BONDERSON: Will you clarify some of these points as to why you might have had this increase in chlorides, as the program develops?

MR. SPONAGLE: This is what we hope to do by this investigation that we propose.

MR. STEIN: I would like to just spotlight two points on the presentation for consideration on the priority system we have here in this very complicated project. One is the problem of accidental spills from mills engaged with radioactive materials, and the other is the Yuma, Arizona water situation where they have had to abandon the river. I think the Conferees may wish to consider those and see if they want to give a priority basis for them.

Now, we do have coffee here, and we would like to have a fifteen-minute recess. We hope you will please be prompt, because as you can see, we have a very large program. I think we are on schedule, and let's try to keep it that way. We shall recess for fifteen minutes.

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MR. STEIN: May we reconvene? Mr. Sponagle, will you please continue with your presentation?

MR. SPONAGLE: The following speakers will now present detailed discussions of the findings and Project activities in each of the areas already mentioned. We will begin this presentation with Dr. Ernest Tsivoglou, who is In Charge, Radiological Pollution Investigations, R. A. Taft Sanitary Engineering Center, and who will discuss the findings and significance of our radiological investigations to the present time. Dr. Tsivoglou.

MR. STEIN: Before you start, I understand there is some difficulty in hearing, and we would appreciate it if you people spoke up.

DR. TSIVOGLOU: In spite of our difficulties in getting our laboratory started in the past year, I think we have considerable data to present which we find of interest. I would like to begin the summary of our radiological studies by observing that, because of the cooperation achieved under our Conference system among the State water pollution control agencies, the Public Health Service, the uranium industry, and the Atomic Energy Commission, considerable progress has been made in improving the radiological quality of the Basin waters and sediments. Certain exceptions must still be noted, and I will discuss them. Our task of improving and safeguarding the radiological quality of the waters of the Basin cannot yet be regarded as completed, but a substantial gain apparently has been made.

The recent field data also demonstrate the real value of the water and sediment monitoring system that is presently being installed and completed. One of the most notable radiological features of this network of sampling stations is its ability to detect very small changes in the sediment concentrations and quantities of radium-226, which has been our contaminant of most concern. The basic field data gathered thus far demonstrate that the network can and has detected radium-226 pollution at levels of only two to three times the natural background quantities. It is a highly sensitive measuring system, with which we are able to trace exceedingly small quantities of radium over long distances from their points of entry into the aquatic environment. As it develops and continues, we think this monitoring system will be a basic means of surveillance and protection of the waters of the Basin.

I would now like to discuss in more detail certain of the more significant radiological findings of the past year. As Mr. Sponagle has noted, individual detailed reports of these and other studies will be completed very soon.

SEDIMENT SURVEYS

Studies on the Animas River and elsewhere during recent years have demonstrated the value of river sediment samples as sensitive indicators of radioactive pollution, and hence during the past year an extensive survey of the radioactivity of Basin sediments was undertaken. The objectives included determination of the radioactivity burden of the sediments, distribution of this radioactivity throughout the Basin, and the effects of river hydrology upon the deposition and ultimate residence. These studies commenced in August, 1960 with a basinwide sediment sampling run,involving some 200 samples. At many of the locations involved, it should be emphasized that this represented only one month of accumulation following the 1960 spring-summer floods, and hence a resurvey was undertaken in March of this year, just prior to the onset of the 1961 floods. This should represent a period of perhaps six or seven months of accumulation of whatever is discharged. Further surveys to complete the picture of the hydrological year will also be conducted.

Upper Basin

Considering first the Upper Basin above Lee's Ferry, Arizona, a total of 15 of the samples, coupled with the results of earlier studies,have yielded a very close estimate of the natural background radioactivity at sampling points above all sources of radioactive pollution. These data indicate a mean Ra-226 concentration in sediments of the Basin of 1.3 μμg/gm. of sediment, with a range of only less than 1 to 2.6. These results constitute a fundamental yardstick against which other data may be compared. Our 1958 studies on the Animas River, for example, indicated a natural radium content of sediment of 1.6 μμg/gm., or a value in quite close agreement.

MR. MARX: May I ask a question here? Where was that result on the Animas River?

DR. TSIVOGLOU: This would be above pollution, above the uranium mill at Durango.

The average result of analysis of some 68 sediments from non-background river sampling stations throughout the Upper Basin was 2.5 μμg/gm. of sediment, or almost exactly two times the natural radium content. The range of results for these data was from less than 1 to 19 μμg/gm. In contrast to this, samples collected in 1958 in the Animas River before waste treatment measures were installed ranged higher than 600 μμg/gm., and in 1956 the San Miguel River sediments contained as much as 2,100 μμg Ra-226 per gram of sediment. The 1960 survey thus shows a significant general improvement, in terms of the environmental radium reservoir and its effects on water quality.

The sediment survey of 1960 also indicated three dry washes near uranium mills with a Ra-226 content of 76 to 275 μμg/gm. Although no water quality effect of importance was immediately apparent at these locations, the results are sharply higher than general environmental data, and additional detailed investigation of local conditions is warranted and will be carried out in the coming year.

Lower Basin

The sediment survey data for the Lower Basin, from Lake Mead to the Mexican border, have provided quite interesting data also, regarding the ultimate fate of radioactive waste solids, as well as the extreme sensitivity of the sediments as an index of pollution.

A set of 11 samples of sediment from the Pierce's Ferry and Las Vegas Bay areas of Lake Mead in August, 1960 yielded a mean Ra-226 content of 2.9 μμg/gm., with a range of 1.0 to 5.5. This sampling run, with the aid of the National Park Service, was limited in terms of area distribution of samples, and hence in late October of 1960, with the cooperation of the Bureau of Reclamation, a second set of sediment samples was taken in Lake Mead. The latter set involved depths up to 400 feet, and was more representative in terms of area coverage. The October data yielded a Ra-226 average result of 4.0 μμg/gm., or three times the natural background result referred to earlier. The range of results was 2.9 to 5.0 μμg/gm. A sample taken from the Virgin River outlet into the lake contained less than 1 μμg Ra-226 per gram, or the natural background concentration.

Proceeding downstream from Lake Mead to Needles, California, a series of four samples yielded an average Ra-226 result of only 1.0 μμg/gm. of sediment, with a range of less than 1 to 1.5. Below this, three samples in Lake Havasu ranged from 2.7 to 3.3 μμg/gm., and averaged 2.8 μμg/gm., or twice the natural background. Below Lake Havasu, a series of five sediment samples to the Mexican border ranged from 0.8 to 1.3 μμg of Ra-226 per gram of sediment, or again, the natural background.

The inferences of these data are clear. The great reservoirs of the Lower Colorado Basin have been shown to be the long-term resting place of the radioactive solids discharged into the rivers of the Upper Basin. The sediments of Lakes Mead and Havasu presently contain about three times the Ra-226 naturally present in river muds of the Colorado Basin.

It has been our experience that even slight contamination of river sediments with radium results in a corresponding increase in the radium content of the overlying water. Water samples collected in Lake Mead to correspond with the sediments in 1960 showed a slight increase of dissolved Ra-226 pollution as compared to the natural content, but this level of pollution, while detectable, was not of public health significance.

Radioactive waste discharges from the uranium mills have been reduced considerably during the past year. In keeping with our basic aim of maintaining the Basin waters at the highest attainable level of radiological quality, this improvement trend should continue to the point that no further increase in the radioactivity of the Basin sediments occurs. In order to determine whether this improvement trend does in fact continue, and in order to determine the degree to which hydrologic factors alter the 1960 distribution of radium in the sediments, these surveys will continue for some time. Results of analysis of the set of sediment samples obtained in 1961 will be reported at our next meeting.

As Mr. Sponagle has said, there were also several two-week river surveys done, and I would like to discuss them a little bit. During the late summer of 1960, several brief but intensive surveys were conducted on the main stem of the Colorado from above Grand Junction, Colorado, to below Moab, Utah, and including the San Miguel-Dolores River system. These investigations thus studied the effects of six of the operating uranium ore refineries (Rifle, Grand Junction, Gunnison, Moab, Uravan, and Slick Rock). They indicated, in general, a slight but detectable level of pollution of the main stem Colorado, not of immediate public health concern. Together with data gathered in prior years, they also indicated considerable improvement in the quality of waters and sediments of the San Miguel-Dolores River system, although some further improvement is desirable in that case.

Studies of the San Miguel-Dolores system in 1955 and again in 1956, demonstrated water concentrations of dissolved Ra-226 as high as 88 µµg/l. (In contrast, the MPC -- Maximum Permissible Concentration -- for radium in water to be used continuously for domestic purposes was then 4.0, as against the 88, and is now 3.3 µµg/l, or essentially the same thing. The natural background content of surface waters runs about 0.3 µµg/l.) However, these waters were not in use as a source of domestic supply. Comparable sediment samples from the river system in 1956 contained as much as 2,100 µµg of Ra-226 per gram of sediment, in contrast to the natural content of 1.3 µµg/gm. These were the highest environmental Ra-226 figures observed in the Colorado Plateau area.

A resurvey in 1959 indicated considerable reduction in the levels of contamination. At that time, the maximum dissolved Ra-226 observed in river water was 15 µµg/l., considerably lower than the 88, but still above the maximum permissible concentration of about 3.3 or 4.0, and the associated sediments contained 50 µµg/gm. as against the earlier 700 to 2,000. In the 1960 studies, sediments contained up to 30 µµg/gm., and water sample dissolved Ra-226 ranged from 2.4 to 5.5 µµg/l. in 1960, or in the neighborhood of or slightly above the MPC level. No direct human water use was evident, although limited irrigation of croplands was practiced.

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The Dolores River, just above its confluence with the Colorado, contained 3.9 μμg/l. of dissolved Ra-226 and the associated sediments contained 8.2 μμg Ra-226 per gram of sediment, or about six times the natural content.

The improvement of the San Miguel and Dolores Rivers over this five-year period is quite evident. However, experience indicates that environmental levels of radium can feasibly be reduced further to levels prevailing elsewhere in the Colorado Basin, and this further improvement should be brought about.

Sediments from the main stem Colorado above and below Grand Junction contained from 3.2 to 4.8 μμg/gm. of Ra-226, or three to four times natural background. Associated river water samples above the confluence with the Gunnison contained 1.3 μμg/l. of dissolved radium, also about three times background. The radium content of waters and sediments of the Gunnison were at natural background levels, and at Westwater, Utah, the dissolved Ra-226 was near the background level of about 0.3 to 0.5 μμg/l. The sediments at that location were only slightly higher than background.

Immediately above its confluence with the Dolores River in Utah, the water of the main stem Colorado contained only essentially natural quantities of Ra-226. The sediments contained less than twice background. Just below the Dolores confluence, the average dissolved Ra-226 was 0.9 μμg/l., or about double the natural quantity, but well below the permissible level of 3.3 μμg/l. Farther downstream, concentrations of 1.2 μμg/l. were observed, with associated sediment Ra-226 concentrations of 4.3 μμg/gm. Thus, some slight gain in dissolved and sediment Ra-226 was observed below the Dolores, but the levels were not of public health concern. Quite limited data obtained prior to 1960 in this reach of the Colorado indicate that some water quality improvement has also been accomplished here.

Animas River

On the Animas River, we have just gotten the results of a few water samples taken near the state line between Colorado and New Mexico during January and February 1961. The dissolved radium content there, from five samples, averaged 0.7 to 0.75 μμg/l., which is well below the earlier levels, and demonstrates considerable improvement -- about the improvement that was expected from the remedial measures.

CROP SURVEYS

Also during 1960, a quite brief exploratory study of the radioactivity of crops grown on farms irrigated with river water receiving mill wastes was also undertaken, with the objective of defining the extent of any problem that might exist in this regard. Eleven samples of crops and seven samples of associated topsoils were analyzed for Ra-226 and their gross radioactivity. These samples were taken from a small number of farms where it was suspected that the irrigation water might contain more than the natural quantities of radium.

Two samples of peaches contained 2.2 and 10.7 μμg Ra-226 per kg. live material; two samples of apples contained 1.8 and 4.4 μμg/kg.; a tomato sample had 3.7 μμg/kg., and a corn sample 0.5 μμg/kg. For purposes of comparison, similar concentrations were observed in similar crops from downstream farms in the earlier Animas River surveys, and background or natural levels in foods such as these appear to be in the neighborhood of 1.0 or 1.2 μμg/kg.

A series of four alfalfa and one hay sample contained Ra-226 concentrations ranging from 30 to 320 μμg/kg., with a mean for the five samples of 150 μμg/kg. These results were about ten times higher than were observed in alfalfa obtained in the Animas River studies. Of course, these crops are not used directly by humans, and many of the factors leading to high or low concentrations at one or another farm have not been defined. However, these data do indicate a definite need for further investigation, and for observing associated Ra-226 levels in meat and milk products.

Associated farm topsoil samples contained up to 17 μμg/gm. of Ra-226, or up to about ten times the natural soil (sediment) Ra-226 content. Again, sufficient data are not available for definite interpretation, but the correlation between Ra-226 in soils and in the corresponding crops appeared to be good. This relation between soil and crop radium content also requires further analysis.

No direct public health significance should be attached to these data at this time, because of the very limited number of samples, the wide area they represent, and the lack of any representative variety of human diet. The few results that are available for crops directly consumed by humans appear to be at the general level of permissible limits for radium intake, and the alfalfa and hay results definitely require further study regarding meat and milk radium content. Only a small number of farms and their products appears to be involved. It is planned to intensify this phase of the Project studies sufficiently in the coming year to more definitely determine the quantities of radium involved, the degree of contamination of the irrigation water used, and the possibilities of other water sources for irrigation purposes.

I wish to emphasize that these data reflect conditions at only a few locations, and do not indicate a basinwide problem. The local problems that appear to be involved should be solved without delay.

ACCIDENTAL RELEASES

One more aspect of the studies in 1960 involves the accidental release of uranium mill tailings liquors. Accidental releases to the environment of mill tailings liquors due to rupture of the earthen walls of tailings ponds have occurred at several locations in the Upper Colorado River Basin during the past ten years. The most recent instance took place late last year in New Mexico. In that case, a considerable volume of highly acid raffinate, having a high radium concentration, spilled to the receiving river over a period of a few hours. An extensive fish kill was observed downstream in the river immediately thereafter. It has been estimated that from 0.5 to 1.0 millicuries of Ra-226 were released initially in the dissolved state. It is not unlikely, however, that because of the wide pH difference, an appreciable part of this radium precipitated on being mixed with the receiving water.

Although several downstream domestic water supplies came from the river involved, the short duration of the release, the quantity of radium released, and the prevailing available dilution by the river led to the conclusion that no humans received significant overexposure to radiation. It must be noted, however, that in past years river flows have been as low as one-tenth of the flow prevailing at the time of the accident, and therefore, that available dilution was more favorable than might have been the case.

Limited sampling of the area immediately following the release, and a later more extensive survey, revealed no major environmental contamination. Daily grab samples of downstream river water covering the period of release were obtained through the cooperation of the U. S. Geological Survey. They did not indicate radium concentrations in excess of permissible levels.

As has been noted, similar accidents, while not frequent, have not been unknown elsewhere in the uranium milling area. Many of the tributary streams upon which mills are located experience extremely low flows during part of the year. Such accidental releases thus represent a distinct hazard to downstream aquatic populations, and depending upon local water uses and other factors, to humans.

It is, therefore, highly desirable that the cooperating groups consider and attempt to develop means by which it can be better assured in the future that such accidents will not occur. One solution to this problem would appear to be the construction of a secondary earthen dike to surround the entire tailings pond area. Such a secondary barrier should be designed and constructed so that although normally dry, it would be able to withstand the load placed upon it by sudden rupture of a tailings pond and safely contain the liquid thus released.

One other aspect of these accidental releases is also considered quite important. In the past there has been a considerable lapse of time between the occurrence of such a spill and the time at which the responsible public health agencies have learned about it. In view of the quantities of radioactive and chemical materials that may be released, it is considered highly important that adequate avenues of communication be established promptly to provide for rapid and effective reporting of such incidents to responsible public health agencies.

The general problem of accidental releases also indicates the importance of the monitoring network and surveillance system that is presently being established

To summarize quickly then, there has been considerable reduction of environmental contamination from uranium milling wastes during the past year. This trend should be continued as far as possible for the radiological protection of the waters of the Basin. The great reservoirs of the Lower Colorado Basin have been shown to be the long-term resting place of these wastes.

Certain specific radiological problems still remain. They involve the degree of contamination of crops at a small number of farms using polluted river water for irrigation purposes, and one tributary river system that still contains undesirable quantities of radium. None of these problems involve an immediate radiological hazard. They will be followed more closely in the coming year, and it is anticipated that they should be solved without undue difficulty or delay. The problem of accidental spills of tailings to the rivers of the Upper Basin has been discussed, and requires the development of adequate measures to protect the water environment, adequate reporting of such incidents, and continued surveillance.

Thank you.

MR. STEIN: Thank you, Dr. Tsivoglou. Are there any questions or comments on my left? On my right? I would like to ask one question. Below this accidental spill, is there any water supply, or water intake?

DR. TSIVOGLOU: Yes. I said there were several domestic water uses. To the best of our knowledge, and this has been followed very closely, if the radium concentrations ever got above the maximum permissible level, they got above it only briefly -- perhaps two hours -- and we must remember that these maximum levels refer to a lifetime of exposure. So, a few hours at two or three or even five times an MPC is not considered significant overexposure, unless it happened pretty frequently.

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MR. STEIN: Did you have a question back there, sir? Would you identify yourself, please?

MR. KAGAN: Harry Kagan, Department of Health, State of Nevada. Doctor, my question is, statistically, how significant are the data presented, in view of the number of samples taken?

DR. TSIVOGLOU: The number of samples taken has not been so limited. I haven't counted them, but I would say we have done in the neighborhood of four or five hundred or more in the past year. On associated radioactivity analyses and on gross analyses, the data are not too limited. Our investigations demonstrate that a considerable improvement has come about in the past year. I tried to indicate that there are still a few exceptions that will be solved in the coming year. Does that answer your question?

MR. KAGAN: Yes, but as a matter of statistics, how important are these figures?

DR. TSIVOGLOU: I think the figures on crops are important, and that they should be followed up without delay. The figures on the San Miguel-Dolores River system were right at or slightly above the maximum permissible levels. The irrigation water samples were also on these levels at present, and therefore, these figures should be followed up as closely as possible, and reduced. I think the question of accidental releases is quite significant, and this problem should be solved as rapidly as possible.

DR. GOULD: I am Earl Gould, of Henderson. In your report, your second specimens always come out with lower figures. Would that be due to lower production in the uranium mills?

DR. TSIVOGLOU: I am not sure. You may be referring to some of the uranium mine human studies.

DR. GOULD: If there was lower production in the mills, would that make any difference in your specimens?

DR. TSIVOGLOU: The only answer I can give you is that we have not been concerned with the uranium mining problem as such, nor with the human studies on uranium millers. These studies are conducted by the Division of Occupational Health of the Public Health Service, and I am not familiar with the results. I don't think they would have effect on our water problems.

MR. MARX: Ernie, in the low concentration of radium in a stream, over a period of time the aquatic plants would pick up this radium and would tend to build up that concentration -- isn't that true?

DR. TSIVOGLOU: This is true.

MR. MARX: And this radium has a half-life of some sixteen ~~to twenty~~ hundred years? This could become quite a problem.

DR. TSIVOGLOU: Yes, and the long half-life, of course, is the reason we would like very much to see that we do not add to the reservoir that is presently in the sediment system of the Basin. We are convinced, and our data show without any equivocation, that this material circulates from the sediments to the water to the biota and back to the sediments, and continues to circulate.

MR. STEIN: For the record, would you identify yourself, sir?

SENATOR MORROW: Yes. I am Senator Morrow, of Arizona. Apparently there is a concentration in the lake areas here, in the sediments. Could that be influenced by the atomic tests in this area?

DR. TSIVOGLOU: No, sir. These are Radium-226 figures, and we do not get radium as fall-out from nuclear weapons. We get it only from the extraction of uranium from the natural ores. It is not fall-out.

MR. GEORGE: I am D'Arcy George, of the AEC. I would like to inquire on this -- do you have any correlation between the known discharge of Radium-226 by the uranium milling industry and the amount of radium which you find in the sediments?

DR. TSIVOGLOU: No, D'Arcy, we have wanted very much to make this computation. The unfortunate thing, and the reason it has not been made, is that we do not have a good estimate of the actual volume of river sediments involved. In other words, one would hope to be able to take the concentration of radium, multiply by the volume of sediment involved, and come up with a quantity; compare this to the amount of uranium ore that has been processed, for instance, in the milling industry; see how you check, etc. We have not made any attempt to do it because we just do not have any good estimate of the volume of sediments. As you know, this would be a pretty difficult thing to get.

MR. RODNER: I am Jack Rodner, of the Boulder City office of the Bureau of Reclamation. I think you said that the ultimate resting place -- I'm following this as a layman -- of these radioactive wastes was in the sediments of the large reservoirs. In the case of Lake Mead, would the accumulation of this over a long period of time be released to the water and eventually cause the use of that water to be a serious factor for human consumption?

DR. TSIVOGLOU: No, sir. I tried to cover that. Let me put it this way. At the present levels of contamination of the sediment of Lake Mead, there is no public health hazard involved. We did find a very slight increase in dissolved radium above the natural quantities, but not an increase comparable to the maximum permissible levels at all. With the reduction of wastes coming into the reservoir system that we have found in the past year, we would not anticipate any trouble like that.

MR. BONDERSON: Do you have any estimates yet of what the total annual contribution of the milling industry is to the system?

DR. TSIVOGLOU: We could make some rough estimates as of 1955 or 1956, and then we could make some other estimates as of 1960. They would be widely different. The total amount of annual contribution as of 1960 should be, I think, quite small.

MR. BONDERSON: You do have data with which this calculation or estimation could be made?

DR. TSIVOGLOU: We could estimate it, let's say, within a factor of ten. I think this would be adequate.

MR. BONDERSON: Ten percent?

DR. TSIVOGLOU: No, I don't mean ten percent. I mean maybe a hundred to a thousand -- somewhere in that kind of range.

MR. MARX: Ernie, I would like to know what the industry itself is doing. Is it assuming its proper responsibility in this area?

DR. TSIVOGLOU: I suspect that we will hear from some members of the industry in a little while. I tried to comment earlier in this talk, and I suppose I did not give it enough attention, on the degree of cooperation that has been achieved under the Conference system with the industry, the water pollution control agencies, and the Atomic Energy Commission. The answer is that the industry has been doing a great deal to try to abate pollution and cut it down to where it ought to be. Does that answer it?

MR. MARX: Yes. Thank you.

MR. STEIN: I think we have this general report, as I see it, which is pretty optimistic. Now, the motivation for self-policing by industry is always difficult to ascertain. I think, one, we have a new industry here, and they are becoming stabilized in regularizing operations. The second point is that we have this cooperative program and a continuing surveillance program. As indicated in various public health programs,

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whether it is water pollution, milk sanitation, or restaurant sanitation, when you get a surveillance program you know you get results in a voluntary way by industry that wants to cooperate. I think the surveillance program will continue, and we are very happy that the results are achieved in this manner.

MR. SAMSON: Mr. Chairman, I am John Samson, and I have a question for the doctor. You will recall that Mr. Sponagle referred to three areas in connection with the uranium, and I have Moab, Utah; Grand Junction, Colorado -- there was another locality I did not get.

DR. TSIVOGLOU: Uravan, Colorado. Essentially, the San Miguel-Dolores River system.

MR. SAMSON: Now, in connection with these locals, you mentioned the Uranium Company of America, Climax Uranium, and Union Carbide, and I think one or two others. Are these industries in these locations in the milling processing licensed by the Atomic Energy Commission to carry on their particular work?

DR. TSIVOGLOU: Yes, they are.

MR. SAMSON: Under that license by the AEC, does that Commission in any manner, shape or form exercise any control or supervision in the matter that we are concerned with here?

DR. TSIVOGLOU: Yes, sir, they do. I think quite a bit. I see one of my friends from the milling industry smiling. They do exert quite a bit of influence. In fact, last year they asked me, with Mr. Sponagle, to take a trip with them around to a number of the uranium mills to discuss waste control practices and things like that. I would say that in the past year or two especially, they have exerted a great deal of influence.

MR. SAMSON: Do they conduct any river surveys, or make any checks in connection with the discharge of this industrial waste?

DR. TSIVOGLOU: They make checks, but not by conducting river surveys. I would like one of the industry members to correct me if I make a mistake here. The industry is required under the provisions of the Atomic Energy Act to report regularly to the Division of Licensing and Regulations on concentrations of materials such as radium that may be present in their effluents. In other words, the AEC control is at the effluent before release. They do not conduct river surveys or environmental surveys, as such.

MR. STEIN: I think we will have a representative of the Atomic Energy Commission here, and perhaps we will get a better answer.

DR. TSIVOGLOU: Yes. I think that was essentially correct.

MR. GORDON: Who is riding herd on these high concentrations that you mentioned in connection with crops produced in polluted irrigation water?

DR. TSIVOGLOU: I think Mr. Sponagle has plans, and the States will have plans with him jointly, and I am sure that the milling industry also will be interested, and that these will be ridden herd on rather closely in the coming year.

MR. STEIN: Are there further questions? Thank you, Dr. Tsivoglou. Mr. Sponagle?

MR. SPONAGLE: The next item for discussion is the water quality control planning aspect of the Project. Before we get into a discussion of specific activities during the past year in this phase of our endeavor, however, we will have a brief presentation of the sectional components which go into this type of work. Mr. Richard Vanderhoof,In Charge, Water Resources Studies, Taft Sanitary Engineering Center, Cincinnati, Ohio, will present this discussion. Mr. Vanderhoof.

MR. VANDERHOOF: It is clear that the area and complexity of the Colorado River Basin problem calls for a comprehensive plan. Under the authority delegated to the Surgeon General of the Public Health Service, to prepare and develop comprehensive programs for eliminating or reducing the pollution of interstate waters and their tributaries, and in other water resources legislation such as Title III of Public Law 85-500, we have built up a competency in the area of comprehensive planning. The elements of the comprehensive plan, and the reasons for such, will be described as I go along here.

During the early period of the development of this country, the available water far exceeded the demand; and the need for water quality control was not obvious. Recently, as demand approaches and even exceeds available supply, multiple re-use occurs, with accompanying degradation of quality. The need for water quality control is now apparent. The quality of water must be tailored to the proposed use, and to achieve this objective is one of the reasons why a plan for water quality control is necessary. It is interesting to note that at the President's National Conference on Water, there was a call for a national policy on keeping water as clean as possible, as opposed to the negative policy of trying to crowd into a stream all of the wastes it might possibly assimilate. Now this is a big change in engineering work. It used to be good engineering to design a waste plant to the maximum assimilative capacity of the stream. Now we have gone about 180 degrees from this, according to this policy.

The objective in planning is to develop a scheme to meet the water demands or needs, considering quality as well as quantity, not only for today, but for the future. An essential part of the planning is the determination of present and future needs.

One of the first steps of the study is to inventory the region. That is, collect all data on population, industry, resources, water uses, existing water supplies both quality and quantity, and sources of pollution. We have found it useful to look at a region through the eyes of an economist. Based on his study of the resources of the region, knowledge of location advantages, existing facilities and job opportunities, he should be able to predict the general pattern of the economy of the area for the future. From this estimate of the economy and job opportunities, population forecasts can be made, and types of industry can be predicted. This information is furnished to the engineer, who can then estimate municipal and industrial water needs. While the economist is busy on his land-use plan, the engineer is working on the inventory of the water supplies, both surface and ground water. Quantity and quality are both necessary to consider in water supplies. I might diverge a little bit here. Water quality planning is not a great deal different than water quantity planning. The difference is that we must tailor the quality into the quantity at the point of need.

Quantity requires a special study of river flow characteristics. The ground water geologist could be used to advantage to study the ground water situation. All available data on water quality are collected, and where gaps of knowledge exist, water samples are collected. Chemists and bacteriologists are then needed to analyze these samples. Water quality data are then related to the existing water uses and to the geology of the area. The States within the area should determine the water quality objectives at certain critical points within the stream. Then we have all the elements needed, and now we need to relate them.

We show on appropriate maps, both basin and sub-basin, the relative locations of present and probable future needs, both quality and quantity, sources of water supply, and sources of population,again emphasizing quantity and quality of each. With this background of information, and a knowledge of water quality objectives, the engineering study can then be made to show how water supply can best be developed for the various needs and locations. And where and how pollution sources should be both located and treated. And whether flow augmentation should be provided at such points to permit re-use.

Recommendations flowing from this study, then, should meet the objective of developing a water plan to achieve the maximum use and re-use of the water.

These, then, are the basic elements of a comprehensive plan, and this is the plan we are following on the Colorado River Basin. Mr.Pahren will discuss the progress of the plans of study, and also the work contemplated for the future.

MR. STEIN: Thank you, Mr. Vanderhoof. Are there any comments or questions? All right, Mr. Sponagle, will you please introduce your next speaker?

MR. SPONAGLE: With the basic elements of water quality planning in mind, we can now turn our attention to the specific Project activities which have taken place during the past year. Mr. Herbert Pahren, who is in charge of the water quality planning studies of our Project,will bring this to you. Mr. Pahren.

MR. PAHREN: Mr. Vanderhoof has outlined the studies which are needed to develop the comprehensive water quality control plan for the Colorado River Basin. We will now review the activities related to this objective since this program was initiated last October, and we will also point out the principal areas of work which we plan for the near future.

For ease in handling data and developing comprehensive plans, the Colorado River Basin has been divided into seven major sub-basins. These are the Green River Basin, Upper Colorado River Basin, San Juan River Basin, Middle Colorado River Basin, Little Colorado River Basin, Gila River Basin, and the Lower Colorado River Basin. A separate plan will be developed for each of these basins, and where applicable, the interrelationships will be taken into account.

One of the first programs undertaken was the collection of data concerning municipal and industrial waste discharges and water uses in the Colorado River Basin. The water pollution control agencies of the States of Arizona, Colorado, New Mexico, Utah, and Wyoming have already been contacted to obtain data of this type.

Waste discharge and water use data are being summarized for each tributary. The points of discharge and use are being keyed to a mileage system, so that these points may be readily located with respect to one another. With this tabulated summary, the interrelationships between water uses and waste discharges will be analyzed, and areas for necessary field studies indicated.

One of the principal gaps that we found in our data is in industrial water use and waste discharge information. Although we may know that an industry exists at a certain location, and the products being produced, little additional data are available.

In those cases where the information from the States is limited, it is planned to fill the existing gaps in one of two ways. Much of the information may be obtained by field reconnaissance surveys, where the necessary data will be obtained from flow and quality records of the towns or industries, by evaluation of local conditions, or by other types of "leg work". In some cases, it is expected that this will not prove sufficient, and more detailed studies will be necessary in order to characterize a waste discharge. For these cases, samples will be taken and flow measurements made of the effluent streams. Participation of the State water pollution control agency will be sought. This will benefit both agencies, since we will have available to us an individual who is acquainted with local conditions and contacts, while at the same time the State will receive first hand any information that is developed in the survey.

In addition, data on irrigated acreage and quantity of water diverted for this purpose was obtained from the Bureau of the Census. This information was collected during the 1959 Census of Agriculture and Irrigation. It is broken down by counties and by small sub-basins.

Another area of endeavor being carried out is a detailed analysis of the U. S. Geological Survey data concerning the chemical quality of water for various points in the Colorado River Basin. The USGS has been collecting chemical quality data since 1925, and these data will be examined to determine trends, causes of poor quality, and effects of development projects on the water quality.

Data from 51 locations in the Basin have been published in the Water-Supply Papers, and 584 station-years with approximately 400,000 bits of information are involved. Each station-year contains about 36 samples, composited for the most part during a ten-day sampling period. Each station sample contains information on 18 determinations, plus flow. The stations are located in the several States as follows:

8 Stations in Colorado	114 Station years
20 Stations in Utah	205 Station years
2 Stations in Wyoming	16 Station years
18 Stations in Arizona	211 Station years
3 Stations in New Mexico	38 Station years

I might add that those stations on the Colorado River along the California-Arizona border and the Nevada-Arizona border were included in the Arizona total.

The Geological Survey reports the principal cations and anions dissolved in the water, along with such characteristics as hardness, sodium adsorption ratio, and conductivity. Since these very useful data are available to us at the beginning of the Project, they will help us arrive at water quality decisions, and guide us in planning additional field work.

Since the available data are voluminous, they are being punched on approximately 21,000 IBM cards, and the analysis will be handled for the most part by machine methods. Each card was designed to contain information for one composited sample of all determinations, plus flow. Punching operations are being completed this month, and then the analysis will proceed.

A few examples of some of the analyses will be mentioned. The various constituents will be related to stream discharge, and the quality-discharge relationship subjected to a statistical analysis to determine the confidence limits of the dissolved constituents for a given flow. This data will also be broken down into seasons, and the seasonal trends over the years will be investigated. Frequency distribution curves will be obtained for each constituent, so that we may find out how often the water exceeds certain limits. The weight of constituents passing the stations along the main stem of the Colorado River will be obtained, so that we may determine the contribution from the different areas of the Basin.

Through the cooperation of the Bureau of Reclamation, much information has been obtained on irrigation projects. Reports, maps, and other types of data were received from the Region 3 office in Boulder City, Nevada, the Region 4 office in Salt Lake City, and at the Denver Federal Center, regarding various existing and proposed Bureau projects. We hope this cooperation and support continues, because the Project objectives require that we obtain additional information on future schedules and programs of the Bureau, which should be incorporated into our studies.

We are planning an initial study of a small sub-basin as soon as possible, in order to obtain the earliest experience with the various problems which will be encountered in developing a comprehensive water quality plan for the entire Colorado River Basin. In this initial study we will rapidly field-test the techniques we now consider essential in the development of the program. We hope to learn how our plans can be improved, and to develop short-cut methods of arriving at essential answers for a larger geographical area. The extra time and effort invested in this endeavor is expected to help us speed up completion of our over-all plan for the Basin.

A comprehensive program for the water quality management of the Basin must reflect the economic conditions expected to prevail for the period of analysis. An economic base study, therefore, is essential in preparation of the program, and will be initiated this summer. It is planned to make this study under contract, and discussions with several agencies capable of performing the work are being held. A preliminary program has been developed on the methods of approach. This study will involve an evaluation of present economic conditions and the potential development in the Basin, including population forecasts, industrial growth, and resource development. The impact of these economic developments will be related to water quality of the receiving streams.

MR. STEIN: Thank you, Mr. Pahren. Are there any questions or comments? Yes, sir.

MR. WILLETS: I am David Willets. I would like to ask the speaker if the computer work with respect to the water quality data is going to be related to the development of the Upper Colorado in the uses of water and the diversion of water trans-mountain, so that the data can be projected into the future to help predict the future quality of the river?

MR. PAHREN: We will have a picture of the trends of past years, and knowing the date of initiation of various developments, these developments can be related to any changes in the water quality, if there are any. If we develop relationships, these relationships will then be taken into account in working with the future water quality.

MR. LONG: Mr. Chairman, could I ask where the two stations are on the Green River in Wyoming?

MR. PAHREN: One of the water quality stations in Wyoming is located on the Green River near Green River, Wyoming. The other is on Black's Fork, near Marston, Wyoming.

MR. WILLETS: I would like to ask you another question. With respect to the economic planning and the study which is to be initiated this summer, do you contemplate in that that you will make any evaluation of the water quality -- let's say, what the value of 100 parts per million of dissolved solids is. We have values for water, as H_2O. To date, no one has attempted to put any appreciable value on whether water of good quality is of any more value than water of higher mineral content.

MR. PAHREN: The economic study we plan to commence this summer will be of a slightly different nature than you point out. This will be an economic base study, which will analyze the present economic condition of the Basin and the expected future growth of the Basin. In other words, what the population in certain areas may be in the years of the future, what industrial growth is contemplated, and things of that nature. This information will then be related to future water quality needs.

MR. STEIN: Mr. Bonderson?

MR. BONDERSON: In making your studies or projections as to what the future water quality conditions may be, are you taking into account irrigation return waters, and the effects of long term storage on water quality?

MR. PAHREN: We will take this into account.

MR. BONDERSON: Both of them?

MR. PAHREN: Yes, I believe so. It is all part of the over-all picture.

MR. MARX: Will you include chemicals supplied to the land which may be in the irrigation tailings, such as insecticides, organic compounds, etc.?

MR. PAHREN: Yes, we do plan this. I believe Mr. Sponagle mentioned this before. We will analyze the water for insecticides, for fertilizer components, etc. that may be in the drainage from the lands.

MR. STEIN: Are there any further questions? If not,Mr. Sponagle, would you continue with the presentation? Thank you, Mr. Pahren.

MR. SPONAGLE: In my presentation of Project activities carried out to date, I mentioned a few times the collection of samples for bioassay and also biopopulation studies made in certain areas. For this work we had the assistance during August and September of last year of Mr. Joseph Anderson, Chief of the Water Quality Section, in the Region VII office in Dallas. Mr. Anderson will now present the detailed findings from the biological aspect of these studies.

MR. ANDERSON: During the summer of 1960, studies were conducted on several uranium mill waste effluents discharged to the Colorado River and its tributaries to determine their toxicity to fish.

Tests for toxicity were made at the Colorado State Fish Hatchery at Durango. Rainbow trout were used as test fish, and water from the Animas River above any pollution from the city or industries was used to dilute the wastes. The test procedure consisted of placing rainbow trout about two inches in length in a series of different concentrations under controlled temperature conditions, and observing the survival of fish in each test container. Physical and chemical characteristics were determined, to associate the cause of death of some fish with test solution characteristics.

Wastes from six uranium mills and one mine were tested for three-day periods with the following results: (The samples included both grab and composite)

1. The Climax mill at Grand Junction discharges wastes to a large impoundment which also receives drainage water and domestic wastes. The impounded wastes are discharged to the Colorado River. The effluent from the impoundment was not toxic to any of the test fish during a three-day test period.

2. The URECO mill at Moab, Utah, discharges mill effluent to a large impoundment. The impounded water is discharged to the Colorado River through a regulated release structure. All test fish survived in samples of waste concentrations ranging from 18% to 32%. Half the test fish died in concentrations ranging from 32% to 42%.

3. At the Union Carbide Mill at Rifle, Colorado, there are two separate discharges to the river. The vanadium plant wastes were discharged to a holding pond located between the mill and the Colorado River, and from this pond wastes were released to the river. It was calculated that half of the test fish would survive in a waste concentration of 2.4%.

   The solvent extraction raffinate was discharged to a holding pond located a few feet from the river. This waste was highly toxic, causing half the test fish to die in a waste concentration of 0.25%. Stated in another way, half of the exposed fish would be expected to die in a three-day period if one part of waste were diluted with 400 parts of water.

4. Two samples of waste were tested from the Texas Zinc Company at Mexican Hat, Utah. One sample of raffinate was collected just before neutralization, and discharged to a large holding pond. On the basis of the tests, half the fish were able to survive for a three-day period in a waste concentration of 0.39%. Another

sample was collected as the waste was released from the pond to a tributary of the San Juan River. This sample was a little more toxic, killing half the test fish at a concentration of 0.20%.

5. At Slick Rock, Colorado, water from the Burro mine which was discharged to the Dolores River was tested for toxicity. This waste water was highly turbid, but was not toxic during a three-day test period.

6. Samples of the tailings waste at Slick Rock, which flowed into the Dolores River, killed half the test fish in concentrations ranging from 1.5% to 2.4%.

7. Four wastes from the Union Carbide Mill at Uravan are discharged separately to the San Miguel River. Drainage from the tailings pile, combined with other ground water seepage, was toxic to half the test fish when this material was undiluted.

   The Pond 5 waste samples containing raffinate and other wastes were toxic to half the fish tested at percentages ranging from 0.42 to 0.75.

   The Red Cake tails effluent was toxic to half the fish in concentrations ranging from 4.2% to 8%.

   The Yellow Cake Press Filter Pond was toxic to half the test fish at a concentration of 2.4% for all three samples tested.

The biological life in three tributary streams was also studied to determine the effect of mill wastes on the streams.

San Miguel and Dolores Rivers:

Bottom fauna studies of the San Miguel River and Dolores River below the uranium mill at Uravan, Colorado, indicated that life in the stream was damaged by the wastes discharged. There were indications that the Dolores River assimilated the wastes and made them less harmful in the first eight miles downstream from the mill.

Animas River:

Studies of the Animas River with respect to the uranium mill wastes discharged at Durango, Colorado, have been made since 1958. Wastes discharged to the river in 1958 were shown to be very toxic to rainbow trout. One of the wastes required a concentration of only 0.1% to kill half the test fish in a 72-hour period. Examination of the stream for life which normally exists among the rocks showed that life was practically eliminated immediately downstream from the mill, and was greatly reduced for 35 to 40 miles below the mill.

In the early part of 1959 a program was initiated by the mill to treat part of the wastes, and entirely withhold the most toxic wastes from the river. In the latter part of the summer of 1959, slight improvement was observed in the bottom fauna of the stream. In 1960, however, a definite improvement in the stream was observed. Greater numbers and more kinds of bottom fauna were living in the stream below the mill than in the two previous years. Withholding the most toxic wastes has helped greatly to improve the water quality of the stream. Both Colorado and New Mexico Fish and Game Departments have restocked the Animas River with trout, and have reported favorable growth of the fish.

San Juan River:

In the latter part of August 1960, the discharge of a large quantity of stored waste from the uranium mill at Shiprock, New Mexico, caused a fish kill in the San Juan River. Samples of waste similar to that discharged were collected for various analyses, including fish toxicity characteristics. The fish toxicity tests were performed at the Robert A. Taft Sanitary Engineering Center in Cincinnati, Ohio. The tests showed the waste to be highly toxic, killing half the test fish in a concentration of 0.41% in 24 hours. River flow was only 82 cubic feet per second at the time wastes were released, so that only about one-third of a cubic foot of waste mixed with the entire river flow would produce a fish kill. Dead fish were reported observed at several locations on the river from the first few miles below the mill to as far as 65 miles downstream.

In November 1960, bottom organisms were collected from the San Juan River upstream from the mill and at four locations extending ten miles below the uranium mill. The flow of the river was considerably greater in November (estimated at 350 cfs) than in August. The higher flow created difficulties in trying to sample the same streambed area that had been exposed to the wastes in August. The collection of bottom organism samples showed a reduced population in the stream one-half mile and three miles below the uranium mill. However, six and ten miles below the mill normal populations were found in the accessible stream areas. Additional stream flow investigations are needed during low flow to determine whether or not effects of mill wastes on bottom fauna can be detected at the greater distances below the mill.

Recommended Studies:

The toxicity studies conducted so far represent only a small portion of the studies needed to obtain the number of sources and quantities of toxic materials received by the streams. Additional studies of the effluents and effluent components would produce useful information for needed waste treatment or waste reduction programs for maintaining or improving water quality of the streams.

Studies have shown that life on the stream bottoms,which is vital to fish life, can be nearly eliminated by the toxic wastes. More studies are needed to determine the normal populations and the changes in bottom populations caused by waste discharges.

MR. STEIN: Thank you, Mr. Anderson. In order to put this in perspective, I think we have to realize that the uranium mills produce chemical wastes as well as radioactive materials. This is a key point. This was one of the really thrilling experiences I had in the Animas River case. Mr. Anderson was invited in to make analyses of flora and fauna below the mill. Our sole purpose was to try to see if there were any accumulations of radioactive material, perhaps in the bone structure of the fish, or in some of the flora below the mill.

When he got there, lo and behold he found practically a biological desert; and obviously, this was not caused by radiation. The stream conditions above the mill were fine, and in the town were fine. He went downstream, as was pointed out, about 60 miles, and there became a recovery with the more durable organisms such as May Flies appearing first, as you might expect when you have any lethal chemical put into a stream. We had a fine example, and one of the finest I had seen -- and this is in other publications -- of scientific detective work done by Mr. Anderson and Mr. Sponagle, a biologist and an engineer, to trace what was causing this and where it was coming from. I think, as exciting and as thrilling as that story was, the fact that remedial conditions were put in, the stream, as Mr. Anderson now points out, shows that trout are now back in the stream and the habitat could be improved. This shows that this is a problem which is amenable to solution, and is one that must be faced up to in the Colorado River Basin.

MR. SAMSON: John Samson again. I have a question to ask. In miles, do you know how far it is from Durango to Aztec, New Mexico, and Farmington, New Mexico?

MR. ANDERSON: It is about 60 miles to Farmington. Aztec is between, at about 35 or 40 miles.

MR. SAMSON: From where do these cities take their water supply?

MR. ANDERSON: They take their water from the Animas River.

MR. STEIN: Are there any other questions or comments? Mr. Gordon?

MR. GORDON: Mr. Anderson touched on one phase of this problem that will become increasingly difficult. That is the drainage from tailings piles. That has already created problems in various parts of the country. I am just wondering whether some positive steps are being taken to reduce that drainage from those tailings piles.

MR. ANDERSON: I am not familiar with the steps that have been taken to reduce the drainage. My work was involved primarily in testing the toxicity of those seeps or other drainage that we could obtain. I think you will find there are a variety of systems used to try to contain the water, but as to where it goes exactly, I think you will find a variety of situations.

DR. PEARSON: No mention was made of the nature of these chemical toxicants. Is this merely a matter of chemical toxicity, or a biological oxygen demand, or depletion of oxygen in the stream?

MR. ANDERSON: In these tests that are referred to, all of them involve chemical toxicity. As you probably know, there is quite a variety of metals, many of which are quite toxic. Zinc is one example. Work was done during most of these surveys to measure the oxygen in the streams. It was always found at a saturation, or near-saturation level.

MR. BONDERSON: Has your work so far covered any evaluation of the biological uptake of radioactive materials other than in the Animas, and if not, is it contemplated in your future studies?

MR. ANDERSON: In my particular studies I did not go into this; however, Dr. Tsivoglou and others have accumulated quite a bit of data on this. Samples have been collected, and I have insisted on collections of both algae and fish, so that these measurements could be made. They are recorded in the Animas study.

MR. STEIN: Are there any further questions? If not, Mr. Sponagle, would you continue?

MR. SPONAGLE: The final portion of our Project report will be devoted to a consideration of the status of the Project Laboratory, and plans for work in that location. Mr. D. Edward Rushing, Laboratory Director, will present this material. Mr. Rushing.

MR. RUSHING: Preliminary negotiations for laboratory space got under way over a year ago. At that time, no government-owned space was available, and the General Services Administration started looking for rental space. On the basis of our specifications, invitations for bids were sent out in July; only one response was received. The bidder would have built a building and rented it to us.

At about the same time, the Air Force Reserve gave up space which it had been occupying in the government-owned building at 1750 South Redwood Road in Salt Lake City. This building houses the Veterans Administration and numerous smaller government agencies. The space vacated by the Air Force Reserve was offered to us by GSA. With suitable remodeling, it appeared that the space could be used for laboratory space. It was felt that the remodeling expense would be more than offset by the advantages; namely, permanency of location, availability of additional space for possible future needs, and government ownership and maintenance.

Arrangements were made through GSA for a private architect to prepare drawings and specifications to serve as a basis for the remodeling bids. Finally, the contractor was given instructions to proceed on April 30, 1961. The contractor has 120 days for completion of the work.

The total space being remodeled amounts to about 7,200 square feet. The administrative office, the biology laboratory, and the low-level radiochemical laboratory are located on the first floor. The organic and inorganic chemical laboratories are located on the second floor. Also, a small high-level radiochemical laboratory is on the second floor. It may appear that these laboratories are scattered, and they are. However, there is an advantage in having some of the work widely separated.

The planned staff is as follows: one senior biologist, four senior chemists, six junior chemists, one junior biologist, one bacteriologist, six aides, an administrative assistant, and three stenographers. The present staff consists of four chemists, two biologists, an aide, an administrative assistant, and a stenographer.

It is anticipated that the laboratory will be ready for occupancy about September 1. Undoubtedly, we will start with a heavy backlog of samples. The radiochemical laboratory will be equipped to perform radium, thorium, uranium, strontium-90, and other radionuclides as may be required.

The inorganic chemical laboratory will be equipped to carry out practically any macro determination which can be reasonably anticipated. It is expected that trace element determinations will be an important function of the laboratory.

The organic laboratory will work on the isolation and identification of organic pollutants from the uranium milling industry, the petrochemical industry, agricultural uses, and miscellaneous sources.

Mr. Henderson will discuss the biological laboratory.

We are considering the use of a mobile laboratory during the coming summer. This would be equipped for biological work and simple bacteriology and chemistry.

Major pieces of equipment on hand or on order include:

1. A low-level beta-counter to be used for determinations of strontium-90 and other beta emitters.
2. Six proportional counters for gross alpha and beta counting and for the determination of radium and thorium.
3. Eight scintillation counters for the determination of radium by the emanation method.
4. Radon bubblers for use in the emanation method.
5. A 400-channel pulse height analyzer and a Frisch grid chamber for use in alpha spectroscopy work. This is very valuable in identifying radionuclides.
6. A vibrating-reed electrometer for radon and radium analyses.
7. A Beckman DK-2 recording spectrophotometer to be used in organic and inorganic spectrophotometry.
8. A fraction collector for use in chromatographic or ion exchange work.
9. Four analytical balances.
10. A large low-temperature furnace for ashing biological and vegetable samples.
11. Four muffle furnaces and controls.
12. Platinum crucibles and dishes.
13. Glassware and porcelainware.
14. Compressor, vacuum pumps, still, ovens, hotplates, and miscellaneous items.

15. Laboratory furniture.

Major equipment which we expect to obtain in the next fiscal year includes:

1. An infrared spectrophotometer for organic pollutants.
2. A gas chromatograph.
3. A flame photometer.
4. A polarograph.
5. Another low-level beta counter.
6. An automatic counting system.

Because of the delays in getting the laboratory operating, it has been necessary to make arrangements with a commercial laboratory for doing most of our radium analyses. Chemical, radiochemical, and spectrographic analyses were also carried out at the Robert A. Taft Sanitary Engineering Center in Cincinnati. We have been able to do some radium and uranium analyses at the laboratory of the Occupational Health Field Station in Salt Lake City.

Samples analyzed at the Occupational Health Field Station during the year included:

76	water and effluents for radium
118	water and effluents for uranium
17	muds for radium
21	vegetables for radium

Samples of a special or research nature which were analyzed included the following:

2	bone samples for Radiological Health Division
10	spiked vegetable samples

The Laboratory Director has spent some time on committee work for the American Conference of Governmental Industrial Hygienists, the American Industrial Hygiene Association, and the Interlaboratory Technical Advisory Committee, which is made up of Public Health Service technical personnel and is advisory to the Radiological Health Division. He also consulted with the Columbia River Basin Project on laboratory space, and with the Farmington Project of the Radiological Health Division on radium and radon analyses. He presented two talks on radium analysis at a conference of uranium mill chemists. This conference was held in October, 1960, at

Grand Junction, Colorado, and was instigated by the A.E.C.

A paper on the determination of radium in silicates was prepared by Rushing, Garcia, and Clark. Papers dealing with other aspects of radium analyses are being prepared.

MR. STEIN: Thank you. Are there any comments or questions?

MR. FLICK: I am Bob Flick, of United Press. Is there any cost for this remodeling project?

MR. RUSHING: I don't know the exact figure myself. Perhaps Mr. Sponagle would answer your question.

MR. SPONAGLE: The construction work, or the estimate we got from the contractor, which includes some $30,000 worth of equipment, was $185,000.

MR. FLICK: Thank you.

MR. STEIN: On the basis of national experience, I will say our location in Salt Lake City, in my opinion, is one of the most desirable I have seen in field laboratories. Given the vicissitudes of big Government operation, the people here have done a magnificent job of getting that established and equipped for the very highly technical work we have here now. This laboratory will be in full operation, I understand, some time this fall. If you are ever in Salt Lake City, we hope you will come out and see it. Mr. Sponagle?

MR. SPONAGLE: Our last speaker will be Mr. Croswell Henderson, who has recently come on duty with the Project Laboratory as Senior Project Biologist. Mr. Henderson will discuss plans for biological studies for the coming year. Mr. Henderson.

MR. HENDERSON: Gentlemen, I guess I am the last speaker on the program this morning, and I know some of you are hungry and others are quite anxious to get back to some of the many exciting activities that Las Vegas hasto offer, so I will be somewhat brief. I do want to tell you a little bit about the biological facilities we will have in Salt Lake City, and some of the biological functions that will be performed throughout the Colorado River Basin, as well as what we currently think may be some of the major biological problems in the Basin.

In the laboratory at Salt Lake City we will be equipped to perform bacteriological work, coliform enumeration by multiple cube, membrane filter techniques, as well as identification of types by various biochemical tests. This same applies to fecals and streptococcal forms. For plankton analysis we will be equipped for concentration of samples, enumeration of different forms, and identification, at least to genus. For bottom fauna or bottom animals, we will be equipped, of course, for sorting, enumeration, identification generally to genus. Fortunately, in the Salt Lake City location we have two very excellent universities close by, the University of Utah, and Utah State, which are both quite well equipped with facilities and personnel to do various types of aquatic biology work. We are going to look to Dr. Sigler and Dr. Gaufin and others to possibly give us considerable help in identification, and possibly some help with special research problems. I am not too familiar with the rest of the Basin, but I am sure there are many other very excellent facilities available also.

As to fish studies, we will expect to do identification, any dissection that is necessary for radiological studies, possible age and growth studies, and food habit studies to see just what the condition might be of the fish in certain of these areas.

We will have a bioassay lab which will be equipped to conduct acute or short-term toxicity bioassays, with both cold and warm water species of fish. The cold water species, of course, are members of the trout group, and the warm water species such as bass, blue gills, etc. which are found in other portions of the Colorado Basin. We will also be able to prepare different types of dilution water for studies in the laboratory somewhat simulating conditions in the field. As many of you know, certain water quality characteristics have a major effect on how toxic a particular material might be. For example, some metals are much more toxic to fish under low pH alkalinity hardness conditions than they are otherwise, and we will be equipped to perform this function.

Later on, with space, financial support, etc., we hope to set up a continuous flow bioassay, where we can go further into long term or chronic effects of certain of these chemical toxicants on fish.

In addition to the above, of course, we will have provisions for washing, sorting, dissecting and preparing any type of biological sample for radium or any other nuclide analysis. Our biology personnel also expects to participate in some of the field surveys with some of the other groups from Denver. We will be equipped with a chemical kit for such things as temperature, pH, dissolved oxygen, conductivity, and some of the major water characteristics. We will also have the necessary water, plankton, and bottom samples -- nets, seines, etc. -- for field collections.

As our major functions, we will certainly be expected to participate in all studies in these selected areas where we have particular pollution problems, and depending, of course, on Project requirements, we will be able to perform any of these necessary functions I have previously mentioned.

As another major function, we expect to begin establishing some biological baselines in certain areas, so that we can look forward to what effect certain future developments in the Basin may have on the aquatic biota in an area. We also expect to conduct some research on problems that may arise in connection with the solution of any specific problem. For example, we would like to know what are the components of uranium mill wastes which cause pretty high toxicity to fish in some cases. With an excellent chemical laboratory and a biological laboratory there where we can work together, we expect to be able to come up with some of the answers to some of these problems. From our thinking currently, some of the major biological problems in the Basin are as follows:

1. Dr. Tsivoglou mentioned to some extent this uptake of radium through the food chain, which involves a number of types of different animals. Your major aquatic food chain, of course, is going from the water to the aquatic plants, whether they are microscopic or macroscopic, absorb these nutrients whether they are radioactive or not, from the water. They are passed on to other organisms such as insect larvae and on through to the fish. So we do know that certain nutrients are highly concentrated, and we expect to make a pretty elaborate investigation of that.

2. Another problem we expect to look at is the possible bacterial contamination from sewage disposal, irrigation return waters, and possibly concentrated recreational developments such as in the Parker, Arizona area.

3. We also would like to look at the plankton problems from the standpoint of nuisances in water supplies, which might be greatly increased by the nutrients from return irrigation waters, and also from the clarification of the river by the silts settling out in some of the dams.

4. The next thing we expect to look at very carefully is to follow along with Mr. Anderson's work and look further at some of these toxic industrial wastes, mine slimes, etc. throughout the Basin.

5. Of course, the pesticide problem is another one. The pesticides may be in irrigation return waters, or I know in certain areas of the Basin, large quantities

of pesticides are used for fire spray, which may run off into streams or drain into the Colorado River.

As far as immediate plans are concerned, we expect to follow through very carefully on the fine biological program that Mr.Anderson has started in the uranium mill area; and to expand that to other industries in other streams that have not been looked into as yet.

We want to do a little more work on irrigation return waters, both through bioassays and in connection with carbon filters, to see if we can find any quantities of pesticides in some of these waters, and what to expect particularly in areas where they have large areas of cotton and receive very heavy treatment of pesticides.

Then, a beginning of basic biological surveys in relatively stabilized portions of the Basin, so that we can establish biological baselines for future operations. We will, of course, continue to make field investigations and collections of all types of organisms which willbe subjected to radium or possibly other nuclide analysis.

MR. STEIN: Thank you, Mr. Henderson. Are there any questions or comments on the laboratory? If not, thank you very much.

Some people have tight time schedules, and I wonder if we could push on with other Federal presentations before we break for lunch. First, we would like to call on the Atomic Energy Commission. Is Mr. Donald Nussbaumer here? Do you have a statement, sir?

MR. NUSSBAUMER: My name is Donald A. Nussbaumer. I am in the Division of Licensing and Regulations, Atomic Energy Commission, Washington, D. C.

We appreciate the opportunity of attending this Conference on the Interstate Pollution of the Colorado River and its Tributaries. Mr. Lester Rogers, who attended the First Session of the Conference, outlined the Commission's regulatory responsibilities and program. I would like to say at this time that this program has continued, including the evaluation of the waste disposal practices of the AEC licensed uranium mills, including those on the Colorado River and its tributaries. It is our objective to assure that exposure of individuals in unrestricted areas to concentrations of radioactive material does not exceed the limits of 10 CFR Part 20, Standards for Protection Against Radiation, which is the regulation all AEC licensees must comply with. The Atomic Energy Commission will continue to take whatever steps are necessary to assure that milling operations are conducted in compliance with the Commission's regulations, and will not endanger the health and safety of the public from radioactive hazards.

As Mr. Rogers pointed out at the First Session, the AEC regulations of pesticides are used for fire spray, which may run off into streams or drain into the Colorado River.

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As Mr. Rogers pointed out at the First Session, the AEC regulations require that concentrations of radioactivity in mill effluent must not exceed drinking water levels when it leaves the licensee's control and enters an unrestricted area, except as may be approved by the Commission. Such approval may be granted where environmental dilution factors are such as to provide assurance that at points of use of the water the concentrations of radioactivity are within the limits for unrestricted areas in the AEC regulations, and the mill operator has taken all reasonable measures to reduce the concentrations as far as possible. Several of the uranium mills have requested permission to take advantage of known dilutional factors with respect to discharge of concentrations of Radium-226. Our general approach in evaluating requests of this type is largely as follows. The AEC looks to see that the requests are accompanied by appropriate survey data on the part of the mill. A representative of the Division of Licensing and Regulations visits the mill to review their waste treatment methods and their liquid effluent survey data, and to assess the potential exposure of individuals in unrestricted areas to concentrations of radioactivity in rivers and streams. Consultants to the Division of Licensing and Regulations, representatives of the Public Health Service, and of the respective State health departments are invited to participate in such visits. Based upon discussions with those participating in such visits, and the present liquid effluent data and waste treatment practices of the particular mill, the AEC may grant an interim authorization to take advantage of environmental dilution in discharging Radium-226.

Certain requirements are imposed as conditions of such authorizations. Typically, these include:

1. Specified limits on the concentrations of Radium-226 in effluents, when averaged over one-month and one-year periods, and limits on the concentration of Radium-226 in the receiving streams.

2. Restriction on the volume of effluent discharged.

3. A limitation of concentration of radioactive material other than Radium-226, to values specified in AEC regulations.

4. A requirement for continuous sampling of the effluent stream, or semi-continuous sampling at no greater than hourly intervals, with the further limitation that samples may not be composited over periods greater than one month.

5. A requirement of substantially complete removal of

suspended solids from the effluent stream.

6. A requirement that records of survey must provide data sufficient for estimating the effects of the effluent discharge on concentrations of radioactive materials to receiving streams.

7. A requirement that a report be made to the Commission before the end of the authorization period on the progress that has been made in developing means of reducing concentrations of Radium-226 being discharged to the unrestricted areas.

Interim authorizations would be for a maximum period of one year. At the end of the authorization period, the Commission would review the liquid discharge program of such mills, and its effect on the environment, prior to granting an extension of such authorization.

It is recognized by all concerned that more information is needed on the effect effluents have on concentrations of Radium-226 in the receiving waters, and that more reliable information about water uses is needed. In this regard, it appears that the kind of information being developed by the Public Health Service on the fate of radioactive materials entering streams in the Colorado River Basin will be of considerable assistance, both in evaluating requests by the mills to take advantage of dilution factors in discharging liquid effluents, and in assuring that such discharges, together with other sources of radioactive materials, do not result in exposure to people of excessive concentrations of radioactivity from the utilization of water resources. This information will be considered in connection with the granting of renewals to such interim authorizations.

The Atomic Energy Commission desires to work closely with interested Federal and State agencies on matters relating to our regulatory responsibilities, and wishes to cooperate in this study in any way that we can. We would like also to express our appreciation to the interested Federal and State agencies for their cooperation and assistance which they have furnished to us.

MR. STEIN: Thank you. It seems obvious in the radioactive aspects of this, we have to work very closely with the Atomic Energy Commission. You might say that we have the closest possible, and most cordial working relationships, and we could not have moved this far without the thorough cooperation of the Commission, and the almost day-to-day consultations with them.

Are there any questions or comments?

MR. WHITE: I understand these mills are all licensees of the AEC. You have a pretty good program at this time, but very obviously, they were discharging in a way to damage this stream. What procedure is there now to prevent this in the future, other than you will do this at the time of renewal of the permit?

MR. NUSSBAUMER: Our program now is concerned strictly with the discharge of radioactive materials, and we have in our regulations means of taking enforcement action where necessary. In other words, if a particular mill were not complying with the conditions of the authorization, the Commission could take enforcement action against them to bring them into compliance.

I should also point out that during the course of authorization, as well as covering all of the licensee's operation in the mill, it is subject to inspection by the Commission's Division of Compliance, whose responsibility it is to gather information relating to the compliance of a licensee to the Commission's regulations.

MR. WHITE: In this case, though, there was a discharge in excess of your regulations. Were you aware of that?

MR. NUSSBAUMER: In which case was that, sir?

MR. WHITE: On these mills on the Animas, and so forth.

MR. NUSSBAUMER: Let me go back a little bit further than that. When we started our regulatory program and began our program of inspection, we did find that a number of the mills were not in compliance with the Commission's regulations. At that time we did take enforcement action, which consisted of issuing orders to the mills requiring them to take certain specified actions to correct these deficiencies and bring themselves into compliance.

MR. STEIN: Are there any other questions? Mr. Bonderson?

MR. BONDERSON: Would you care to comment on this observation? We are told that the individual uranium mills are to keep the AEC advised of the characteristics, and I presume the quantities, of radioactive materials that are discharged.

MR. NUSSBAUMER: Yes, sir. That is a condition of some of the licensees.

MR. BONDERSON: We have also been told that apparently you can only make an estimate of the total amount of radioactive materials that are being discharged to the system within an accuracy of, say a factor of ten. An accuracy of ten -- that's a pretty --

MR. NUSSBAUMER: I think in that instance, Dr. Tsivoglou was referring to an estimate, based on information available at the present time, rather than a strict determination based upon detailed survey results at a particular mill.

MR. BONDERSON: Well, the material you have, the information that is being submitted by the dischargers, is this adequate to make such an estimate?

MR. NUSSBAUMER: I think the information we are getting now from the mills will be accurate enough to make a pretty firm estimate on the amount of radioactive material being discharged.

MR. BONDERSON: Thank you. I see.

MR. CALDWELL: Is the AEC still relying on self-inspection by the mills?

MR. NUSSBAUMER: No, not completely. As I pointed out, we have a Division of Compliance, whose responsibility is to inspect all licensees, including the mills, periodically, to gather information to see whether they are complying with the Commission's regulations.

MR. CALDWELL: Your regulations, though, will set up certain standards -- but you don't actually get into design and construction, do you?

MR. NUSSBAUMER: Well, design and construction would be evaluated in terms of licensing. In other words, in order to obtain a license in the first place, an application must be submitted which describes in detail what the applicant intends to carry on in the way of an operation, so there is a pre-evaluation.

MR. CALDWELL: There is an evaluation, but let's put it this way. Do you review the plans and specifications for all phases of plant operation and waste discharge?

MR. NUSSBAUMER: Yes, in connection with licensing we would.

MR. STEIN: Are there any further questions or comments? Mr. Hernandez?

MR. HERNANDEZ: I am John Hernandez, of New Mexico. You speak of these reports by the mills to the AEC. Are these reports made available as a routine nature to the States where these mills are located?

MR. NUSSBAUMER: No, sir, I don't think they are.

MR. HERNANDEZ: How do you know when such a report is made? Or rather, how does the State know when such a report is made?

MR. NUSSBAUMER: These reports are submitted to the Commission, and they are put in the AEC public document room.

MR. HERNANDEZ: How would a State know when such a statement is received in the public document room?

MR. NUSSBAUMER: I don't think they would have any way of knowing.

MR. HERNANDEZ: How would a downstream State, such as Arizona or Colorado, have any access to this information?

MR. NUSSBAUMER: They would have access to the information from the public records, sir.

MR. CALDWELL: Well, why can't we get copies of these reports?

MR. NUSSBAUMER: I don't see any reason why you can't.

MR. CALDWELL: Mr. Hernandez tried to get a copy of a report reflective on Long John, and he was told he could read the report at the agency office in Albuquerque. He read the report and made some notes, and then he was told not to use the notes.

MR. NUSSBAUMER: Well, I think the report referred to here was an inspection report, which according to the regulation, is an internal document. Now, if you are talking about reports that licensees submit to the Commission, these reports are a matter of public record. The inspection reports that the Commission inspectors fill out when they inspect a licensee on the matter of compliance are not a matter of public record.

MR. CALDWELL: Why not?

MR. NUSSBAUMER: This comes under the Administrative Procedures Act, I believe. It is a policy that all Government agencies are required to follow, as I understand it.

MR. REDMAN: I am Travis Redman, of Texas Zinc. Did not the Commission offer to the States the privilege of assuming these obligations if they wanted to?

MR. NUSSBAUMER: Yes, sir. That is right.

MR. REDMAN: In which case, they would not only have access to the reports, but they could ask the questions?

MR. NUSSBAUMER: There is an amendment to the Atomic Energy Act which was made in 1959, which would allow the Commission to relinquish regulatory responsibilities over certain radioactive materials to the States.

MR. REDMAN: That's isotopes, normally.

MR. NUSSBAUMER: Yes. That is what we call by-products source and special nuclear material, which would be the isotopes, the source materials, uranium and thorium, and special nuclear material, the reactor fuel in amounts less than critical mass.

MR. REDMAN: But you are not relinquishing your responsibilities as far as the mills are concerned to the States -- or are you?

MR. NUSSBAUMER: Yes, sir. The mills would be included in that category.

MR. HERNANDEZ: I would like to ask if you are requiring the mills to report to you anything other than the quantity and quality of the radioactivity. Are they reporting the acid wastes, or the tailings wastes, or other wastes to you?

MR. NUSSBAUMER: Our authority covers only the radioactive material aspect of their operations.

MR. HERNANDEZ: Then isn't there an awful gap here? You are assuming responsibility for the mill, but they have these other toxic wastes that are going in completely uncontrolled.

MR. NUSSBAUMER: Well, I am not sure who would control the toxic chemical wastes. Presumably the State would have control over that. I don't know.

MR. GORDON: I find the relationships so greatly improved over what they were a couple of years ago that I hesitate to comment about it. One question, however, arises in my mind. Is the AEC and its Licensing Division now willing to abide by the recommendations of the Public Health Service and some of the State agencies who have capabilities in this direction, or are they still unwilling to accept these recommendations and rulings?

MR. NUSSBAUMER: Well, sir, let me say this. I think we are willing to consider any and all recommendations. As to whether they are accepted, that is another matter.

MR. GORDON: Well, that's just Washington-ese talk. I'd like to get an answer.

MR. STEIN: Are there any further questions or comments? Mr. Hernandez?

MR. HERNANDEZ: I would like to get a definition of an unrestricted area in the concept of ground water.

MR. NUSSBAUMER: An unrestricted area in the regulations is defined as an area over which the licensee does not exercise control.

MR. HERNANDEZ: In other words, the ground below a tailings pond would be an unrestricted area?

MR. NUSSBAUMER: Yes.

MR. HERNANDEZ: Have any reports been developed by any of the mills on pollution of the ground water tables?

MR. NUSSBAUMER: I am not sure.

MR. STEIN: If there are no further questions, thank you very much, Mr. Nussbaumer.

At this point we would like to adjust our schedule, and deviate from the calling of the Federal agencies to call on Mr. Robert Beverly, of the Union Carbide Nuclear Company, for a very short statement.

MR. BEVERLY: Mr. Chairman, members of the Conference, and guests.

Union Carbide Nuclear Company, who operate several uranium mills located on the Colorado River system, have been concerned about radioactive pollution for many years. Cursory monitoring studies on effluents discharged from the mills were initiated in the early fifties. It became apparent in 1959 that a thorough evaluation of certain radionuclides contained in the effluents should be made, and that a comprehensive monitoring program should be started.

That same year Union Carbide established a radiochemical laboratory in Grand Junction, Colorado, where new analytical techniques were developed and evaluated.

The comprehensive effluent and river monitoring program initiated in 1959 consists of continuous sampling of effluents released to unrestricted areas, and routine daily or weekly sampling of river waters above and below all mills. Composites of these samples are assayed for certain radionuclides, such as radium, thorium, uranium, and in some instances, for numerous chemicals such as sulfates, chlorides, phosphates, etc.

Throughout this program Union Carbide has worked closely with the U. S. Atomic Energy Commission. The Commission periodically receives reports on our sampling methods, our analytical techniques and the results of all our radiochemical analyses. Just last month the Commission received some 800 assay results from our 1960 monitoring program, along with flowrates of the effluent streams, the river flows, and dilution factors.

As far as radioactive materials are concerned, in most instances large dilution factors result in there being no detectible increase in concentration in the river waters over background. At one mill where the dilution factor is not large, a radium decontamination circuit was installed, and since that time the radium concentration in this mill effluent has been consistently below the maximum limit established in the Federal Part 20 Regulations.

More recently, we have been working with the U. S. Public Health Service in comparing sampling and analytical results. As I stated at last year's Conference in Phoenix, we will continue to cooperate with the Federal and State agencies in this program.

In conclusion, I certainly want to thank Mr. Gahr and Mr.Thatcher for their invitation to come to this meeting.

MR. STEIN: Thank you, Mr. Beverly. Are there any comments or questions? Mr. Bonderson.

MR. BONDERSON: I think Mr. Beverly is to be commended for being here and participating in the meeting today, and I would like to talk further on this subject this afternoon. I would like to ask this question. We have had some problem in California with industries submitting technical data on their discharge characteristics, as they feel this should be in some instances a confidential matter. Do you know whether your company would feel that the information they are submitting to the AEC might fall in the confidential category?

MR. BEVERLY: We have not felt the data on our effluent streams are of a confidential nature, and have reported it. Of course, we are required to report it anyway, but maybe our best answer to this is that we try to keep the State agency, Mr. Gahr's office, informed on what we are doing on this work in connection with any pollution.

MR. BONDERSON: Thank you very much.

MR. STEIN: Thank you, Mr. Beverly. May we call on Mr. George, of the Atomic Energy Commission. Will you stand? Do you have a statement?

MR. GEORGE: I have no statement to make. I am with the Grand Junction Operations Office of the Atomic Energy Commission. We are the purchasing depot, or the agency for the uranium products which are produced.

MR. STEIN: Thank you. Next, the Department of Agriculture, Mr. Sandals.

MR. SANDALS: Thank you. I represent the Secretary's Office in connection with the river basin work in the Pacific Southwest. In the Colorado River Basin I am Chairman of the Agricultural Advisory Committee. We have no formal statement to make at this meeting. I am working very closely with Mr. Nasi in connection with cooperation, and we have many things which we think we can offer.

MR. STEIN: And in the Department of Agriculture also, we have Mr. Clark, of the Forest Service. Are you here, Mr. Clark?

MR. CLARK: Yes, sir. I have a brief statement.

I seem to be the only Forest Service representative here, but it is a pleasure to meet with this dedicated group and discuss pollution problems on the Colorado River Basin.

The Forest Service is vitally interested in the problem of pollution. Although Forest Service lands comprise but one-eighth of the area of the Colorado River Basin, we figure that fifty percent of the water yield comes from these lands. The management of national forest lands under our multiple use legislation recognizes the importance of a sustained yield of useable water from these lands. We have been and are now taking steps to reduce sedimentation in streams originating on or passing through these lands. For example, our timber sale contracts spell out specific measures to minimize and control erosion on the sale area. These measures include protection of the streams and streamside areas.

In cooperation with State and Federal highway agencies, we participate in the location of roads and suggest measures to be included in the construction that will prevent erosion. Our grazing plans provide that grazing will be confined to areas on which forage can be harvested without watershed damage.

We are doing our best to prevent pollution associated with the rapidly increasing recreational use on National Forest lands. In this, we are in certain areas participating closely with State and public health agencies. We are rehabilitating damaged watersheds to prevent accelerated erosion, as rapidly as funds are available under the Forest Service Soil and Water Program, the Cooperative Small Watershed Program, or Public Law 556, and Emergency Programs.

In conclusion, I will say that the Forest Service will be happy to cooperate with the State and local pollution control groups where National Forest lands are involved.

MR. STEIN: Thank you very much, Mr. Clark. Are there any questions or comments?

MR. LONG: Is Mr. Clark out of the Denver office?

MR. CLARK: No, sir, I am out of the Ogden, Utah Regional Office.

MR. STEIN: We will go on now to the Bureau of Reclamation. Mr. Jacobson?

MR. JACOBSON: Geographically, the Colorado River system is composed of two general areas, known as the "Lower" and "Upper Basins". These, through interstate compact designations, constitute separate areas of water allocations and also regions of jurisdiction of activities by the Bureau of Reclamation, as Regions 3 and 4 respectively. The Country of Mexico, established at the river's mouth, lends an international interest in the Colorado River system.

Because of the diversity between the two areas, the Bureau would prefer to present its statement in two portions. Mr. Rodner, of the Lower Basin, will follow me in the discussion.

The river's total drainage area of 244,000 square miles, or more than one-twelfth of the United States, produces an annual average runoff of approximately 17-3/4 million acre-feet, which is less than one-tenth of the flow of the Columbia River from an area almost equal in size.

From the Upper Basin's 110,000 square miles, or less than one-half of the total system, comes over 90 percent of the river flow. Under the terms of the 1922 Colorado River Compact, about one-half of the water originating in the Upper Basin must pass downstream to satisfy users in the Lower Basin and in Mexico.

Presently, there are being consumed in the Upper Basin approximately 2.5 million acre-feet annually, or one-third of its allotted use. Although several large Bureau of Reclamation projects are operating in the Upper Basin, the greatest portion of the water use has been brought about through numerous private developments. It is estimated that six Bureau of Reclamation operating projects, totaling about 225,000 acres in the Upper Basin, deplete the flow by an average of about 380,000 acre-feet annually. In addition, the Bureau has constructed four transmountain diversion tunnels carrying an annual average of 420,000 acre-feet to areas outside the Upper Basin. There are roughly a million acres of privately developed irrigated lands in the Upper Basin, and several small private transmountain diversions. Depletion from these private uses approximates 1.7 million acre-feet.

New Federal projects now under construction or authorized for construction along with some new private developments, will raise depletions in the Upper Basin to about 3,850,000 acre-feet annually by 1970. The bulk of this early new Upper Basin development is included in the plans for the Colorado River Storage Project and its participating projects. All four authorized units of the Storage Project -- Glen Canyon, Flaming Gorge, Navajo, and Curecanti -- are under construction. Of the eleven authorized participating projects, six are under way; namely, the Vernal Unit of Central Utah Project; Florida, Paonia, and Smith Fork projects in Colorado; the Hammond project in New Mexico; and the Seedskadee project in Wyoming. A new private development of immediate significance will be the new Denver City diversion from the Blue River.

The quality of Colorado River water has not inhibited its general use for a large variety of purposes, and the prospects are good for continued adequate water quality for present and new projects in both Upper and Lower Basins. However, to allay any fears of water quality deterioration beyond useable standards, Section 15 of the Colorado River Storage Project Authorizing Act (Public Law 485,April 11, 1956) states: "The Secretary of the Interior is directed to continue studies, and to make a report to the Congress and to the States of the Colorado River Basin on the quality of water of the Colorado River."

The Bureau of Reclamation has cooperated extensively with the U. S. Geological Survey in establishing the necessary gaging and chemical water quality stations in the Upper Basin, in order to ascertain the status of various parts of the river system under present day operations and conditions. The U.S.G.S. is about to complete a detailed compilation of available basic data in the Upper Basin. The first interim report in this regard by the Bureau is scheduled for release in F.Y. 1963. In addition, the Bureau of Reclamation utilizes the full-time services of an engineer from the Public Health Service detailed to the Bureau's Salt Lake City office for the specific purpose of assisting in planning and operating Bureau projects in accordance with proper sanitary and water quality requirements. In following these procedures, it is the Bureau's aim to provide for the greatest possible and appropriate use of the waters allotted the Upper Basin.

MR. STEIN: Thank you. Are there any comments or questions?

MR. LONG: Are you out of the Denver office?

MR. JACOBSON: No, sir. I am the Regional Control Engineer out of Salt Lake City, Region 4.

MR. BONDERSON: I have one brief question. When was the Bureau of Reclamation authorized or directed by Congress to make these water quality studies, and have there been any reports filed to date on this directive?

MR. JACOBSON: The directive was through Public Law 485, dated April 11, 1956, which is the Authorizing Act of the Colorado River Storage Project and the cooperating projects. No formal report has been submitted. The first one is scheduled, and will be an interim report. Of course, there will be continuing studies, and later reports, but this first interim report is scheduled for Fiscal Year 1963.

MR. STEIN: Thank you very much, Mr. Jacobson. Mr. Rodner?

MR. RODNER: Gentlemen, I am somewhat surprised at being up here reading this paper. I haven't seen Mr. Jacobson for a number of years, since we worked together in Denver, and he handed me these sheets and said, "This is the Lower Colorado River portion of this". I understood I was to come over here and give you some of the physical problems that stem from the salinity increase at Yuma. However, I'll read this paper, and then if time permits, I will be very happy to give you some brief words on the situation at Yuma.

In 1960, the net depletion of stream flow on the main stream of the Colorado River between Lee's Ferry (Compact point dividing the Upper and Lower Basins) and the northern international boundary with Mexico was about 6,600,000 acre-feet. This depletion was attributable to consumptive use of water for irrigation, domestic, municipal, and industrial purposes; reservoir losses; and net losses in the main stream channel sections downstream from Lee's Ferry within the United States. In addition, present uses on tributaries in the Lower Basin are estimated to deplete the flow of the Colorado River on an average of about 1,500,000 acre-feet annually. It is estimated that Bureau of Reclamation operating projects diverting from the main streams accounted for about 75 percent of the Lower Colorado River main stream depletion within the United States, resulting from irrigation, domestic, municipal and industrial uses in 1960. The Bureau of Reclamation Salt River Project, with an irrigable acreage of about 240,000 acres, represents about 20 percent of the presently irrigated land on tributaries in the Lower Basin, and accounts for about 30 percent of the tributary depletions. Bureau of Reclamation projects operating in the Lower Basin are the Salt River Project, Gila Project, Yuma Project, Yuma Auxiliary Project, and the Boulder Canyon Project which consists of the Coachella and Imperial Divisions. Of about 1,100,000 irrigable acres included within these Bureau of Reclamation projects, about 800,000 acres were irrigated in 1959. About 4,700,000 acre-feet were diverted from the main stream and tributaries to supply these projects in 1959.

Potential and proposed Bureau of Reclamation projects under investigation would increase the irrigated acreage of land in the Lower Basin about 50,000 acres, and would provide a supplemental water supply for about 650,000 acres presently irrigated.

Increased recreation development at Bureau of Reclamation reservoirs in the Lower Basin has been creating a problem of pollution control. With the present intensive recreational use of the reservoirs and streams indicating a need for extensive expansion of recreational facilities to serve the expanding population of the area, together with increasing depletions of rapidly decreasing stream flows, the problem of pollution control could become critical. Also, the increasing urban and industrial development in the Lower Basin points out the need for the control of the disposal of domestic and industrial wastes on the Lower Colorado River and its tributaries.

As in the Upper Basin, the Bureau of Reclamation has also cooperated extensively with the Geological Survey in establishing and operating gaging, sediment load, and chemical water quality stations in the Lower Basin. The Bureau of Reclamation is also cooperating with the Public Health Service to the extent of collecting samples to be sent to laboratories designated by the Public Health Service, and making a partial analysis of water pumped from Lake Mead for use in Boulder City, Nevada.

The Bureau of Reclamation is also particularly concerned over the possible pollution of water by industrial and domestic wastes entering the reservoirs and streams of the Colorado River system. Adequate control becomes more imperative with the expanding recreational, industrial, and domestic uses of the waters of the Colorado River.

That concludes the statement that was handed to me a few moments ago.

MR. STEIN: May we hear about Yuma now?

MR. RODNER: I will tell you the Yuma situation so that at least the geography will be better known to this group. Actually, our contract with the City of Yuma calls for the measurement of water at Imperial Dam, and that Dam is some fifteen miles from the City of Yuma. The diversion point was the choice of the City of Yuma, and not the choice of the Bureau of Reclamation. They chose to divert that water within the city limits of Yuma and below the confluence of the Gila and the Colorado -- this was their own choice, because they naturally added a lot of salt, and a bed-load of silt when they hit that point. Also, I might point out just for background, that the contract calls for only 25 cents an acre-foot, and that is Boulder storage, with no charge on the first ten thousand acre-feet. This seems a reasonable charge for domestic water, in this day and age.

They have two options, as I see it, or maybe more. They are presently taking their water from the main Gila syphon across the Colorado River, and of course, they are getting de-silted water there. All they need, apparently, is chemical treatment. Now that water contract, if one should be finally realized, would be between the Yuma Valley people, whose water comes through the syphon, and the City of Yuma. Of course, the Bureau of Reclamation would have an opportunity to review and check that contract.

Another possibility, if the city so saw fit, would be to go up higher on the river and bring their water supply in from a point more distant than they are getting it at the present time.

I might say that below the confluence of the Gila and the Colorado Rivers, I see little chance of that supply improving in quality. The districts around the city of Yuma, on which they are largely dependent for their livlihood and I think, their wealth, are just coming to a point where drainage is getting to be a very, very serious problem. A great deal of that drainage is going into the Gila River, and I do not see any practical way at this time of handling that water so as to obtain a better quality of water at the point where they are presently diverting their water supply.

I would be glad to try to answer any other questions, if you care to ask them.

MR. STEIN: Thank you. Are there any comments or questions? If not, we will probably get back to that this afternoon. I would like to call on Mr. Iorns, of the U. S. Geological Survey.

MR. IORNS: Before reading my statement, I would like to introduce two representatives from the Geological Survey who are here: Mr. C. C. McDonald, Project Hydrologist in charge of the Lower Colorado River Project; and Mr. Burge Irelan, the staff chemist, Quality of Water Branch, assigned in Mr. McDonald's office.

Section 15, Public Law 485, 84th Congress, directed the Secretary of the Interior to continue studies and to report to the Congress and to the States of the Colorado River Basin on the quality of water of the Colorado River. In the Department of the Interior, the Geological Survey and the Bureau of Reclamation both have responsibilities for water resources studies in the Basin.

The Geological Survey has in progress hydrologic studies which will culminate in reports on the water resources of the Colorado River Basin. These special studies, which began in the Upper Colorado River Basin in 1957 and in the Lower Basin in 1960, will supplement hydrologic studies that have been in progress in the Basin for many decades. In these studies special emphasis is being given to the chemical quality of surface water and ground water.

The report for the Upper Basin will include a compilation and analysis of data on the occurrence and distribution of the surface and ground water resources, and on their chemical quality. The report will contain monthly and annual summaries of chemical quality data for about 340 station years of record at 41 sites in the Upper Basin, where daily records of chemical quality have been collected. It will also include over 2,400 chemical analyses of surface water from more than 850 miscellaneous sites in the Basin and in addition, about 1,000 chemical analyses of ground water from the Upper Colorado River Basin.

The report for the Upper Basin will also contain an analysis of streamflow behavior under present conditions of upstream development. This will provide a base for evaluation of the effects of future water resource developments in the basin.

The project in the Lower Basin involves a comprehensive study of the hydrology of the area. Principal effort is directed toward study of the storage, and movement of ground water, because of the potential importance of this resource and the paucity of information on the extent and hydraulic properties of acquifers. Areas which are served by Colorado River water, such as Imperial and Coachella Valleys, are included in the study, though they are not tributary to the Colorado River.

The study will include an appraisal of the chemical quality of the water supplies.

MR. STEIN: Thank you, Mr. Iorns. Are there any questions or comments here? Does Mr. McDonald have a statement to make?

MR. IORNS: I included Mr. McDonald's statement in mine. However, he may wish to make additional remarks.

MR. McDONALD: I do not have any additional statement to make.

MR. STEIN: Do we have a representative of the National Park Service here? If not, we will stand recessed for lunch. Because of plane schedules, we would like to reconvene promptly in an hour, with the State presentations and the discussion, which is probably the most important part. We do not want to cut that short. We will reconvene in an hour.

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MR. STEIN: The Conference is reconvened.

At this point we would like to call on the States for the presentation of their statements. The first State is Arizona, and we call on Mr. George W. Marx.

MR. MARX: Thank you, Mr. Chairman. I have not prepared a statement. I am going to talk from some notes, however. Those of you who were not at the First Session should get a copy of the summary of that session, which laid the groundwork for this session.

We in public health are used to prevention rather than cure, and we feel that this Project which has been started on the Upper and Lower Colorado River Basin is an excellent chance to demonstrate prevention rather than cure. As you know, in the midwest and the east they are having their problems because they have permitted pollution to exist for a long period of time by trying to say that the streams will stand so much. I think that is the wrong concept, and it is not a modern concept. It is much easier to prevent a problem from occurring than it is to correct one after it has occurred.

I want to personally congratulate the Public Health Service for the very excellent progress made, in spite of the various difficulties involved in starting a Project of this kind. It is a tremendous Project, and we learned this morning of more problems that may exist other than our problem about Radium-226, which was the first thing that started us off on wanting to do something about it. They have had difficulty in getting analytical equipment. They have had difficulty in getting qualified personnel to staff this Project, and as you heard also this morning, they have had difficulty in getting their laboratory set up.

Regarding Arizona's participation in this Project, we have been doing water pollution work in the State of Arizona through the State Health Department for some eleven years or so. We started about 1949. All of our information is available to the Public Health Service. Some of it already has been used, and will be compiled in reports of the future. We collaborate with the Public Health Service on this Project wherever we can.

As you know if you study the Upper and Lower Colorado River Basins, the State of Arizona is almost 100% one of the watersheds for the Colorado

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River. We believe that better treatment methods are in order regarding industrial and domestic wastes. We think quite a bit of research needs to be done in this area. In Arizona we do not have a dilution factor, as a rule, on the tributaries of the Colorado, at least. We have a lot of dry rivers, so we have to have pretty good treatment, and we do require pretty good treatment.

During the last three and one-half to four years, under Public Law 660, there have been some ten million dollars worth of sewage works constructed in the State of Arizona, which carried some three million dollars in Federal grants. All of these plans and specifications have to be reviewed by our department before they clear to the Public Health Service, who eventually pay the grants.

We have a research project on, in collaboration with the University of Arizona, on survival of pathogenic micro-organisms in oxidation and stabilization ponds. We would like to make further use of our waters -- re-use our waters as much as possible. Water is precious in Arizona. We can learn a nice lesson from our larger mining industries in Arizona, where they do not throw away one single drop of water. That water is re-cycled, and used over and over again. On this stabilization pond study, no research has been done on the survival of the pathogenic micro-organisms, as far as we have been able to find, and our research has not shown that such a study has been made. This will be very important, because if we can find a method of unlimited use of effluents, then we can make more use of our precious water.

As you heard this morning, there are some four basic data sampling stations on the Colorado River in Arizona. One is at Yuma, one at Parker, one at Lake Mead, and one at Page. We receive these reports every month, review them, and compile them. These reports are sent to us by this Project -- the U. S. Public Health Service Colorado River Basin Water Quality Control Project.

There has been considerable interest in Arizona also in the possibility of re-charging the underground water with our waste effluents and industrial wastes. This will possibly be a study conducted by the University of Arizona, together with the State Health Department. We do use quite a bit of our sewage effluents in Arizona for irrigation of animal crops. On our industrial wastes, we have one or two problems we have to watch pretty carefully, and these are chromic acids, cyanides, and phenols. We have quite a lot of electronic projects in the State, some electro-plating, some large and some small. We have to watch our ground water supply in that relation also. We have had some pollution which occurred during World War II from chromic acids, and it takes three or four years for that to clear up, depending upon geological and local situations.

The only domestic sewage entering the main Colorado River is at Yuma, Arizona. We do not permit any of the concessionaires to put any effluent into Lake Mead or any of the lakes down below, or into the Colorado River itself. We are wondering if we should not study the boating situation on these lakes. I learned in talking with Wally White that they have developed some regulations on waste disposal from fishing boats and pleasure boats.

Somebody mentioned the Yuma situation this morning. It has developed into quite a problem. I would like to give you a description of that project that we feel is involved in running these chlorides up so high. Mr. Sponagle said this morning that it has run up to 800, but we have the last two reports that show 900 and 920 parts per million, with a corresponding rise up to 975 parts per million total hardness. The Welton-Mohawk Irrigation District is approximately 75,000 acres, at a cost of $28 million dollars spent for irrigation works, and twelve million dollars spent for drainage works. The drainage canal was built in line downstream to a point near the Gila syphon by December of 1960. Flow became measurable in late November, increased in December, and affected the quality in the Colorado River by early January. You can see here the way she was running. Then in December and January she jumped way up there, and she has been up there. At the same time, at Boulder, at Lake Mohave, it has been staying pretty constantly down around 150 parts per million, and that's quite a radical change.

The State Health Department, and particularly the Bureau of Sanitation, has committed itself to helping Yuma to solve this problem, if it can be solved. I would like to point out that even though we do solve the Yuma problem so far as their domestic water is concerned, we still have some neighbors to the south, and these irrigation tailings are not going to help the quality of the water below the border, and we may get some repercussions there.

I was very much impressed with this morning's program. I don't think I will say any more, except that we are happy that this program is underway. We think it is a wonderful undertaking, and we will participate within our facilities. Thank you.

MR. STEIN: Thank you, Mr. Marx. Are there any comments? I would like to make one comment. As I understand this, Yuma has abandoned the Colorado River as a source of water supply.

MR. MARX: No, they haven't. They take most of their water out of the canal, but they are still taking some water from the River. I wish that Mr. Carl Schmidt, who is General Manager of the Arizona Water Company, would come up here and say something. He runs the water company at Yuma, and he is the one involved. He is coming up now.

MR. SCHMIDT: I would be glad to outline very briefly the extent of our problem. Yuma, Arizona's domestic use is probably one of the highest in the United States. They average per connection on a year round average, a daily average of 1,000 gallons per customer per day. We hit a peak during the summertime last year of 16 million gallons per day, and that is for 8,000 connections, so you can see there is a tremendous water use. The main point that the water use has upon the current problem of chlorides is this. We must provide a large water production facility for getting the water out of the river, and therefore, right now we are not equipped to take all the water that we could use to serve the customers. It is going to involve a considerable outlay of capital, plus time, which means we will go through the summer with pretty salty water in Yuma. It is quite noticeable that the taste level in Yuma hits about 375 parts per million. Generally speaking, I think the health standards call for something like 250. We are riding, even with our dilution, which is about a ratio of two parts of canal water to one part of river water, about 550 parts at this particular time, because the river, as George pointed out, is running between 800 and 900 parts.

We have had the cooperation of both our own State Health Department and George Marx. We have had the cooperation of the U. S. Public Health Service investigating this, and we have had the cooperation of the Bureau. They are trying to work with us on a solution, one which would be economically feasible in the operation of the water company and to the citizens of Yuma, but it is a question largely of time, and an interim policy to be taken care of this summer. I think we will have a long range solution. I think our differences as to the costs are outside of this Conference problem. The main thing is the actual occurrence, and will it happen again, and how it can be prevented from happening again by other government developments or State developments that take place upstream from a domestic source. I think that is what this particular group should consider as a long range future plan, to keep such things from occurring. Yuma has been on the river there since -- oh, gosh, I think our rights go back to 1890 or so, since we have been taking water out of the river. The water quality has been good, as George pointed out, until about October of last year.

I would like to repeat one thing. I think the misunderstanding between the city and the Bureau in the plans for the Welton-Mohawk did come about, and we were not completely informed as to what was to be done with the return flow from the Welton-Mohawk Project. It is our understanding that there is something in the order of 2,300 to 2,400 ppm of chloride being returned to the river, and in recent years there has been less and less water coming down the river to Yuma, with all of the other projects that are above it. We don't have a dilution factor that we can even work with in the river itself.

George, I don't know if there is anything else to be pointed out, except the fact that it looks like about 50% of the Welton-Mohawk Project is developed, so even if a leeching situation would occur, and the return flow from the present lands were to become better, there is still 50% of the land to go, so it is going to be a long range problem of fighting the salt in the river at Yuma, Arizona.

MR. MARX: Thank you, Carl. Are there any questions?

DR. GOULD: I am Earl Gould, of Henderson. What are you doing about golf clubs in your area?

MR. MARX: I don't exactly follow your question. Do you mean as to the service of water to a golf club?

DR. GOULD: Are you allowing any new golf clubs to come into your area, or restricting the water?

MR. MARX: No. There has been no restriction in terms of quantities of water. Our problem has been with quality, and the current golf club that is in the Yuma area at this time has its own well supply that they take care of their fairways with. The domestic supply at this club comes from our system.

MR. STEIN: Are there any further questions or comments?

MR. MARX: Thank you, Carl. That ends my presentation.

MR. RODNER: Mr. Chairman, I am Jack Rodner. I would like to point out just one thing for the benefit of the group here. This drainage problem involves almost all of the area around Yuma, and I think this point should be recognized. The life of Yuma depends pretty much on the irrigation around there. If we are going to let these lands seep, and if anyone thinks they are not, I cn show them areas like the sand beach down at South Gila that are just as white as any Waikaiki Beach ever dared to be. If you are going to let the irrigation lands go out of business, I suspect that Yuma will become pretty much a stage stop for people on their way through. You can't have your cake and eat it too.

MR. SCHMIDT: Carl Schmidt, of Arizona Water Company. I think that Phoenix, Arizona would be a rebuttal to the gentleman's statement. We are not going out of business, and we have taken a lot of irrigated lands out. If anything, Phoenix is larger than ever, because of the development that has taken place through industrial and other sources, which certainly would not be able to develop if a good quality of water were not available.

MR. STEIN: Right. I suggest this to the Conferees. We might consider this Yuma situation, since it involves a public water supply, as one of our top priority items for next year, to work out an amenable solution. I have watched these things through the years being parried about, irrigation districts going out of business, paper companies going out of business, oil companies going out of business, etc. I have always found, if we put our minds to it, we come out with a reasonable quality of water, and we haven't lost any businesses yet.

MR. MARX: Mr. Chairman, I just want to say here, it is not a question of putting agriculture out of business at all. Our problem is to find a solution to this, as far as the quality of domestic water for the city of Yuma is concerned, maybe from some other source; we have been talking in terms of going above this point and getting a better quality of water.

MR. STEIN: This may be a topic that the Conferees will want to consider. I don't doubt that with the developments here, the Yuma situation might well receive top priority, or one of the top priorities of the task of this Conference group for the next year. Hopefully, we will move toward a solution of that problem, and I would expect that in the solution of the problem, as we have always worked in the water quality management, it is certainly not conceivable that we would want to create any economic havoc. Our purpose here is to provide municipal water supply for a multiplicity of uses, and create the least possible ripple on the body politic. It certainly does not mean to undermine the vested economic structure of the community. I think that will be well taken.

MR. GAHR: Mr. Chairman, might I take a moment to ask Mr. Rodner a question? Have we really gone into the matter of irrigation practices so far that there is no possibility of exploring them further, to the extent that we could devise different methods that might better utilize the water to the plant, and tend to reduce the return flow? I think I read some figures that 16% -- maybe that's in error; maybe it is 20% -- of the water that is placed on the field, or gets there, is used by the plant. Maybe we could look in that direction. Is that a possibility?

MR. RODNER: In all honesty, I don't think we have scratched the surface on good water utilization, but unfortunately, it is a great deal like they say the solution of this water problem is in Yuma. When you start educating a few million-odd farmers, you don't do it over night. We are working on that, but to give you an honest answer, I don't think the surface on conservation of water on plants is even scratched, in the seventeen western states.

MR. STEIN: Are there any more questions or comments on the of our top priority items for next year, to work out an amenable solution. I have watched these things through the years being parried about, irrigation districts going out of business, paper companies going out of business, oil companies going out of business, etc. I have always found, if we put our minds to it, we come out with a reasonable quality of water, and we haven't lost any businesses yet.

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MR. STEIN: Are there any more questions or comments on the

Arizona presentation? If not, we will proceed to California, Mr. Paul R. Bonderson.

MR. BONDERSON: Mr. Chairman, Conferees, Participants. I have four points I should like to comment on, and before making my first comment, I would like to reiterate the statement that we called to the attention of the Conference a year ago. That is, in Southern California there are approximately ten million people who are partially or totally dependent upon the Colorado River supply for domestic and industrial purposes. That portion of California that lies within the Salton Sea drainage area, and that portion which drains directly to the Colorado River Basin, are directly dependent entirely upon Colorado River water. Their entire economy is based upon the use of Colorado River water.

In light of this fact, we would hope, and express the desire that, the long-range aspects of radioactive waste disposal into the Colorado system be given appropriate weight and emphasis in this over-all study. That is, we are dealing with a subject here that apparently is an accumulative item, and that we should evaluate this in terms of decades, not in terms of what is going to happen next week or next year. There is being disposed into the Colorado system material in X-quantities each year, and apparently no one knows for sure, but very little of this is being flushed from the system. It is being accumulated, and we should evaluate this over the long-range viewpoint.

My second point deals with industry; that is, the production and processing of uranium materials. There has been a lot of discussion as to what the industry is or is not doing. I should like to see this Conference persuade industry to submit to this Conference a rather detailed report and evaluation of what they are doing. I think it is very well that we had a representative from one segment of the industry here today. I would like to see this from the whole industry the next time we meet. Not that we would want a report from each individual industry, but it seems that they could get together and give us a consolidated report on what the industry is doing.

Next, regards the raw data. There have been a lot of figures kicked around here today. Considerable data has been gathered. I would like to see this raw data put into circulation, for the benefit of the technical people in the various States involved, for their information and edification.

My last point deals with the policy as it relates to establishing water quality standards which will be the basis for water quality management within the Basin. I should like to call to the attention of the Conference, and particularly to the attention of the Public Health Service, who are doing this work, that California has recently adopted a very significant policy as it relates to water quality management. This stems from action taken by our State Legislature two years ago. The net result of this action is that California's policy might be stated as giving maximum emphasis to maintenance of high quality water, and somewhat de-emphasizing the ultimate or maximum use of waters for waste disseminative capacity.

What I am saying is this. I am not implying that the State nor anyone else should ignore or not give proper emphasis to reasonableness; in fact, this is a key point in California yet. Nor do I believe we should ignore the principle of cost benefit. This is still an integral part of California's program, and I should like to file with the Conference recently adopted policies by the State on the subject of evaluation of water quality projects, and sections of a statement that Mr. Rawn as Chairman, and myself presented at a convention recently on this subject.

That concludes my remarks, Mr. Chairman. I would like to call on others from California, if I may.

MR. STEIN: Yes. Perhaps we may have questions or comments on your remarks up to now. Are there any questions or comments?

MR. SAMSON: Mr. Bonderson, do you have a situation comparable or compatible with the Yuma situation, in Southern California? It seems to me I have read or heard something about a Tijuana River. Is that similar to the situation in Yuma?

MR. BONDERSON: No, I don't think the Tijuana situation is comparable. I think we do have a situation comparable in principle; that is in the Lower and Upper San Joaquin area, near the delta in the San Francisco Bay, where the return irrigation waters being discharged into the San Joaquin system -- and considering also the fact that the San Joaquin is a totally developed system, and there is little or no water left for diluting these waters -- the mineral content is continually getting higher and higher, and it is reaching a point where these waters are of questionable value for the use to which they are being put. The State is now in the process of developing a master drainage system that will extend for many, many miles up the San Joaquin Basin, to take these out of the natural drainage ways, and carry them to the Bay or to the ocean for ultimate disposal. Possibly the Department of Water Resources shortly would like to further comment on this subject.

MR. STEIN: I think we have two points here. One, you mention this raw data which should be put in circulation. So far as the Public Health Service is concerned, under this study I think we have this policy. We are a public agency, engaged in a public business in a public manner. I don't think we have any data, raw, finished, or otherwise, which is not available to inspection. If we get data of that kind, we can't use it, because we have to use it for the purpose of the study.

I think another point that Mr. Bonderson made is a key point. Mr. Vanderhoof alluded to this, earlier. He said this was an engineering switch of 180 degrees. This is something that some of us have sensed for a very long time, and that is the point that I think maybe questionably, we have been behind what the American people have been asking. What they want is for the water to be as clean as possible, not for us to put the maximum amount in. This comes from a philosophy which I think we all have, of people spending millions and millions of dollars on unguents, perfumes, deodorants, etc., and taking a bath or a shower every day whether we need it or not! Now, this notion about using a stream up to its maximum capacity just doesn't fit in with what the American people are demanding. I think our point is to keep everything out that we possibly can. Obviously, as Mr. Bonderson indicates, we have to apply the rules of reason, but specifically in getting particularly to a very sensitive kind of waste, which is radioactive waste, I don't think the American people, or the body politic, is going to be satisfied with any kind of objective more than approaching the background level. This is something that has been put on us, and we have to face. This is what we have to work with.

I think again, whether there is a public water supply or not -- and this came out in Senate hearings this week -- that the American people are not going to be satisfied with putting pollutants in the streams which destroy the recreational potential, or kill the fish and destroy the aquatic life in the streams. I think, particularly in a relatively arid area such as we have here, we can't get a water of too good a quality, because with the use and re-use of that water, it just can't be too good. We just have to keep this up.

To take you to another area, and a real humid area, or wet water area, I would like to take you to the St. Louis problem. In St. Louis, you have the confluence of the Missouri and the Mississippi Rivers. There is so much water going past there that in the ingenuity of man when we started, we thought we would never be able to pollute it. But those boys worked at it, and they have!

We got to the point where finally, with some of the major oil refineries in the country installing some treatment works at considerable expense, and the average cost of those for an industry, for just one plant, was over a million dollars, we reduced the phenol content so the water below the St. Louis area finally became palatable. Some industries are still putting in phenols. The question here became, could we allow this chemical company, one of the major chemical companies in the country, to still put their phenols in the water. We looked at it and they had appropriated the complete assimilative capacity of the stream just by discharging their own phenols. If any other industry came into the area we'd have a taste and odor problem again. Obviously, this could not go on, because this area is expanding all the time, so we came to the inevitable conclusion that no phenolic waste could go in, or at most, only a bare minimum, since "no" and "never" are big words. I think this is what we are going to face in this area. As the water is going to be used and re-used, as every new industry is coming in, as more lands are being put under irrigation, as the population grows, there just is not going to be this leeway, and we have to have this cushion for expansion. This means very, very rigid quality control.

Are there any other questions for Mr. Bonderson?

MR. NASI: Mr. Chairman, I believe Mr. Bonderson indicated he was going to submit a policy statement. Do you have a printed policy that you are going to submit as part of the record?

MR. BONDERSON: Yes, sir. It is incorporated into the California Administrative Code, this policy statement.

MR. NASI: And you will submit that for this record?

MR. BONDERSON: Yes, sir.

(NOTE: This policy statement is included as Appendix A.)

MR. STEIN: That is consistent, as I understand it, Mr. Bonderson, with the suggested national credo of the Water Pollution Control Conference, that everything be kept out of the water that can be.

MR. BONDERSON: Well, I wouldn't go quite that far.

MR. STEIN: Not quite that far. Do you want to call your other people now?

MR. BONDERSON: I should like to first call on the board member representative from the Imperial Regional Water Pollution Control Board, Mr. Bevens. Do you have any comments?

MR. BEVENS: Nothing more than you have said, Paul. I think you have covered the thing as well as I could. You are as familiar with it as I am. The only thing I would like to say is that we are at the end of the water system, and get everything that is left in it.

MR. BONDERSON: I would like to call on Dave Willets, from the Department of Water Resources. I think he has a comment, plus further elaboration on Mr. Samson's question.

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MR. WILLETS: First, Mr. Chairman, I would like to express my gratitude for being able to be here, to hear the results of the Project so far. They are very encouraging to us in the Department of Water Resources to see such a competent study of this nature being made. It was gratifying to me, and I know to our Department, to learn of the excellent progress being made to date.

I want to say that I endorse everything that Mr. Bonderson said. We feel his comments are very pertinent to the studies being conducted. We are happy to learn that the data will be made available as it is secured. I would like to emphasize one point, and that is that in California we are making extensive plans today for the operation of our water resources. We are planning to use and re-use our water resources many times, and this has been expressed here in this Conference many times. We are at this time planning a ten-million gallon per day plant to reclaim the sewage, as a pilot plant, from the San Gabriel Valley, and re-charge ground water with that re-used water. In the Santa Ana Valley, east of Los Angeles, we use and re-use our water supply many times, so that the quality of water supply to that Valley is very important to us in considering how many times we can re-use it. We are mindful of the quality of Colorado River water, because a few years ago the total dissolved solids content exceeded 800 parts per million. Obviously, we cannot use and re-use that kind of water. We can use it maybe once before we have to dispose of it. If it were of better quality, we could re-use it several times.

We are concerned, then, with the quality of water received by the Lower Basin. We do not want the Lower Basin to be in the same position as Yuma is today, caused by irrigation return water. This is why we are certainly glad to see that the Public Health Service is seriously considering the evaluation of all the water quality data, and we hope that it will permit the accurate evaluation of what our future water quality will be. As I have stated, this is a vital water resource to all of Southern California. Thank you.

MR. STEIN: Thank you very much. Are there any comments or questions? Mr. Bonderson.

MR. BONDERSON: The last individual I would like to call in is Dr. Pearson, representing the Metropolitan Water District of Southern California.

DR. PEARSON: I have very little to add. I might say we are very much interested in preserving the quality of the Colorado River water. Some ten years ago we became concerned with the activities of the A.E.C. at the Nevada test site. We started a radiological monitoring program at that time, testing the increments in radioactivity that might be caused, and were caused to a minor degree, by the testing activities not so far from here. When these activities ceased, we were hopeful that the radiation levels would drop back to the same levels that we had experienced in 1951 through 1953 and 1954, before the age of the hydrogen bomb. However, with this new potential source of pollution, we may not be able to see this come into being, but we know that the levels of radioactivity have dropped, from our measurements, and we hope they will continue to drop. We appreciate the fact that there is an investigation going on to monitor the upstream pollution. We are going to continue to monitor the downstream pollution, and if it starts up again, you will hear from us!

In addition, I might say that we are interested in the maximum beneficial use because of the shortage of water. In Southern California we have been known to turn industries away from the area if they consumed large amounts of water and employed only a few people. In other words, we suggest they move into areas of greater water supplies. I think this might be kept in mind by some of the other Western States ✓ where they want economic growth -- be a little more selective in the invitations to industries to come into the areas, so that the water will be used for maximum economic benefit to the most people.

MR. BONDERSON: Thank you. That concludes California's statement, Mr. Chairman.

MR. STEIN: Thank you, Mr. Bonderson. Do you have a comment, Mr. Gordon?

MR. GORDON: Yes. Dr. Pearson, you folks depend very largely on the Colorado River? Your principal source of water is the Colorado River, is it not?

DR. PEARSON: Yes. The Metropolitan Water District has the Colorado River as its sole source of supply. We are, of course, participating in the State plan to bring Feather River water from Northern California into Southern California, at which time we will be supplied with two different waters, and probably be mixing these two waters to improve water quality -- we hope.

MR. GORDON: Is there any truth to the statement that the water you folks are getting is not useable on the citrus groves; that the citrus groves are passing out for two reasons: 1) the water; and 2) that about half a million acres a year are being pulled out for housing developments? I have been told that the water coming in from the Colorado River is no longer fit for the citrus groves.

DR. PEARSON: I think you have been misinformed. We have been conducting experiments at LaVerne on some sixty acres of citrus that draws through the Metropolitan Water District, and our tests to date indicate that we would not expect a decrease in productivity in the citrus orchards with Colorado River water on soils that are of normally good drainage and satisfactory for citrus production.

MR. STEIN: If there are no further comments, thank you very much, Mr. Bonderson. We now call on Colorado, Mr. William N. Gahr.

MR. GAHR: Mr. Chairman, Conferees, and Participants. This statement was prepared in the Colorado Department of Public Health, after a meeting with some of the members of industry and also with our newly, and I should add informally devised Inter-State Agency Committee. Consequently, the statement reflects the views and comments of these people in Colorado.

I might go back to the First Session of this Conference, by way of background, to point out that at that time it was officially asked by several of the States that a request be made to the Public Health Service for this study to develop data useful in abating pollution found in the waters of the Colorado River system. These studies, as you know by now, are well under way. At least, many of them are, and others are being planned. The first phase of the program, then, in getting started,seems to be pretty well in hand.

At this Second Session of the Conference, our interest is to learn of what has been accomplished, particularly with respect to character and quantity of pollutants found in Colorado River system waters, and this has been unfolded to you. Quite a bit of data has been developed during the last fourteen to sixteen months, as the reports this morning relate. It is also our purpose at this time, as I recall from the First Session, to make some recommendations for the guidance of this particular study; I plan to do that in a moment.

Although the measurement of pollutants found in the waters of the Colorado River system can now be said to be off to a good start, it must be admitted that we still lack a planned effort for filling in gaps. The gaps, simply stated, are the need for additional water quality studies within the State. I think this is rather important for many of the States to consider at this time. Some of the States are well ahead on this type of thing; others are not.

The way I understand this Public Health Service study is that it encompasses surface waters of the entire seven States, and while there is quite a program in operation, it still doesn't cover many of the little details that occur within the State. We in the States should address ourselves to that need. The need, of course, is the detailed information results that are requested by both industry and agriculture. You know, these questions cause people to search for answers, and in their search for answers they turn to people whom they presume can give those answers to them. Usually, these questions end with many of us present in this room. I feel that we in the States should give some thought and consideration to preparing ourselves to develop more of this data.

After these recommendations, and they seem to have a great similarity to those that have already been presented by Mr. Bonderson and Mr. Stein, these data, in my opinion, are actually public property. Consequently, they should be made available to the public. As a matter of record, I would like to outline our thinking on a procedure for handling such data.

We would like to have the release of raw scientific data on a quarterly basis, and of course, with the permission to distribute it. Of course, if it is in our hands, or any public body, it is subject to dissemination in various manners.

We would like to have the Public Health Service and the Project give thought to assembling these data in such a fashion that they can be readily and easily extracted by the State organization, or the agencies in the State having responsibility for water pollution control. This would be either on a river basin basis, or by areas within each State. In our State, I think we would certainly want to have it set up so that we could have information from the Green River, the Upper Colorado, and the San Juan Basin; we could then readily extract and distribute such data.

Finally, perhaps we can work out the problem that is of State interest as far as Colorado is concerned. It is in each State that we need to get more data on a State-level basis. In this specific instance, the study of oxygen levels is of importance to our State. Perhaps we and the Project people could work out this matter directly.

Mr. Chairman, that is all I have to say.

MR. STEIN: Thank you. Are there any comments or questions? You know, this might be resolved, and maybe Mr. Sponagle wants to speak on this while we are here -- the making available of data on a State or river basin basis. What were you thinking regarding this?

MR. SPONAGLE: Perhaps I can clarify that a little. The way we propose to distribute the data from these field studies we make is not to wait for the completion of any comprehensive study. As these results are obtained, reports will be written covering each particular study. We now have nine or ten drafts that are subject to a little more review before being put out, but the information will be distributed to all interested parties just as soon as the lab data is finished and the report is available.

MR. STEIN: How are you going to make these available -- on a river basis, or State? What is your plan?

MR. SPONAGLE: Oh, I see what you mean. By State, I would think. Each report may be somewhat different, however. For instance, take the Dolores-San Miguel report we talked about here. This will be written up in report form. It will be a short report written up on this study, and will be distributed from the Project.

MR. STEIN: Then it will vary from report to report, as you get them?

MR. SPONAGLE: They will be reports of a particular field investigation.

MR. STEIN: How about your raw data?

MR. SPONAGLE: The raw data will be in the reports -- all the data that we collect will be included in the reports.

MR. STEIN: That is what we want to make clear. Again, this is in accordance with our policy. When we have the widest interest in the nation in this data, certainly all the data that we have is completely available, and to the best of our ability will be distributed to you and will have the widest possible distribution.

MR. GAHR: As to time limits. Some of these studies are going to run for many, many months. Would it be possible to have interim distribution of the raw data? This might be very useful.

MR. SPONAGLE: At certain phases of these investigations, it will be possible to prepare an interim type report. We have to have sufficient data to do this, but I'm sure this could be worked out so that we can get this information into the States' hands as rapidly as possible.

MR. STEIN: Let me state this, as a matter of policy. Our purpose is to make the data available as rapidly as possible, in as wide a manner as we can, to be most useful. This obviously has certain limitations, but our only limitations are staff and budget. I am not speaking in terms of over-all staff and over-all budget, but I am speaking in terms of diminishing returns -- whether it is advisable to put these out daily, weekly, monthly, quarterly, etc. However, I think this is a problem which can be worked out, and certainly no data will be kept by us if by dissemination it can have a useful purpose by the States, industry, etc.

MR. MARX: I was going to ask you this. When he said this distribution would be by States, does he mean that any studies made in Arizona, for instance, would not be available to Colorado?

MR. SPONAGLE: No. As Murray said, this is public information.

MR. STEIN: This information will be made available from a categorical point of view, on a State basis. However, any information we have is available to anyone here. As a matter of fact, it is available to anyone in Maine! You people won't have to ask for it. In other words, all the States participating will, I hope, and correct me if I am wrong, get all the available data. If you are interested in more copies, just ask for them. If you get a single copy concerning something in Arizona, and you are interested in having additional copies, just ask for them and you will get them.

If we don't have any more on Colorado, perhaps we can proceed to Nevada, and Mr. Wallace White.

Mr. White and Mr. Ray Zink have been our hosts here, and have given us the excellent arrangements. Again, I would like to say we have been to many of these Conferences and meetings, and I know of no place where we have had as salubrious surroundings as we have in Las Vegas, or as good a meeting room. At noon I made a check -- and I don't want this interpreted as scientific data -- but none of our boys have gotten rich here yet.

MR. WHITE: Mr. Chairman, Conferees, and guests. We are glad Las Vegas can afford these very attractive surroundings. We are pleased and relieved that everything has worked as well as it has, and we hope something doesn't go wrong to foul things up. The stories we hear, of course, are not yours, Mr. Chairman, that no one made money. They have all told me they have been making expenses, and a little bit on the side!

It is very pleasing to hear all of these neighbors stating a policy that we have had in Nevada for some time. Our statutes are very clear. They say, "You will not pollute water". This is a little rough sometimes. I wonder sometimes what right we have in writing these various discharge criteria, "Thou will not pollute water". We admit, too, we have been quite spoiled. The water supply we had at Lake Mead -- I thought we were the only users of it. I suspect that we are going to have some degradation. Just how much is another question. Lake Mead, as you learned today, is the depository for the wastes from upstream. This is also the water supply for the Las Vegas area's growth and development. Now, if this were published, someone would say, "we have wells", and I would point out -- and I'm getting to be quite old in this deal -- I get embarrassed and quite ashamed, and begin to tremble a little bit when I refer to some of these things, because they were a long time ago. But when I started on this job there were wells all over this valley that discharged into the city mains at pressures of thirty pounds per square inch. This is gone today. Lake Mead is our only water supply.

We are vitally concerned at the relief provided by this surveillance program. We would encourage the development of these comprehensive programs, with the stream quality criteria continuing Lake Mead as the principal and only drinking water supply. When I mentioned this developing a comprehensive program, including us, I suspect we have some adjustments from this valley that have to be made. I hope some of you can very shortly sit down with me and we can work out what has to be done, so that we can plan to get it done. We are a receiving State. We expect to receive this water in a quality that we can use, but we should also expect to make corrections.

Apparently, the initiation of this Colorado Project was opportune. For this, we in Nevada are extremely grateful to the upstream people who were alert to this problem and called it to our attention. I wasn't. I wasn't too enthused about getting involved in it. From everything we have heard today, it was opportune, and time that this be done. We want to be kept advised, and to participate in the continuing program, obviously because as a receiving State, it is necessary and to our benefit.

We would encourage the study of these radiation wastes, but we hope that this is not a simple study, but that along with this there is a concurrent program of correction.

This is my statement, Mr. Chairman. Thank you very much.

MR. STEIN: Thank you, Mr. White. Are there any comments or questions? We will call next on New Mexico, Mr. Charles G. Caldwell.

MR. CALDWELL: Thank you, Mr. Chairman. Conferees, and participants. We in New Mexico are very pleased and very happy about the studies that have been made on the Animas River, and the San Juan. We feel that a very critical problem was solved when we secured correction of the waste discharge of the V.C.A. mill in Durango. We are also pleased that a sewage treatment plant was built up there, and we know that the quality of water for Farmington and Aztec has been improved.

There have been three incidents during the past few years relating to uranium mill wastes, and I would like to point them out. In our Ambrosia Lake area we found one mill which had been using nitrates. They built up a concentration in the underground waters of up to about 80 parts per million, and they were aghast when they found out what they had been doing. There was the problem at Durango that I have mentioned, where the discharge of radium into the stream was quite high, and this last year we had the break at the Kerr-McGee mill.

The Kerr-McGee mill brings up a point. Who is really responsible for handling the waste problems of that mill, which is on Indian land? As I understand the situation this morning, the A.E.C. says they have the right to review the plans and specifications. I would like to see them review the plans and specifications on all of the mills and all of the waste ponds in New Mexico. I have been to the Kerr-McGee mill, and I can assure you all that those ponds were not engineered. They were just dikes that were shoved up, and they held some water. I could see no evidence of compaction. I would like to invite the A.E.C., therefore, to share the responsibility with us, and to work with us. We would be glad to do that, and we would not be nearly so quick to criticize when these breaks occur. We take those things very seriously. We are very concerned at the present time in the Ambrosia Lake area that we may be getting unnecessary contamination of our underground waters. We don't particularly like that.

The expense to the State of New Mexico has been fairly considerable. We have one or two men over in the Ambrosia Lake area or up around Shiprock quite frequently. We are faced right now with the problem that we are going to have to provide our own chemist, and have him trained. We will have to establish a laboratory to make analyses. This is the only way we can see it, because this uranium industry is going to go on a lot longer than we had thought in the beginning.

We are very pleased with the accumulation of data on the water quality network. We feel that when the Navajo Dam is completed, it is going to make a tremendous change in the downstream uses. For example, Bloomfield, Farmington, Aztec, and Shiprock will all be faced with a crisis. The Farmington water intake is a short distance below the Aztec sewage outfall. There is going to be some return irrigation water which will be saline in character and not too high in quality, and by the time it gets to Shiprock they are going to have a pretty tough water to get along with unless there is some dilution factor provided when the Dam is placed in operation.

I was very pleased to hear one of the speakers this morning state that they would be able to forecast to some extent the quality, and that is being considered. Certainly, it must be considered at the present time.

To give you an idea what the area is like, there was a test well drilled near Shiprock to 1,770 feet. It yielded 150 gallons per minute, but had a sulphate content of 2,000 parts per million. You can't live with a water like that, so we are very hopeful that a minimal dilution factor will be provided upon the river at all times.

On the ponds along the river at these uranium mills, one thing we would like to see is for the Public Health Service and the A.E.C., or maybe those two agencies and the States, get together and establish basic criteria for the construction of such ponds. I believe that the Public Health Service came up with the idea of providing a secondary dike system which would contain up to 150% of the initial dike. I think that is just exactly what we need, an insurance factor. This is very practical. There would, of course, have to be modifications for various specific installations.

We also feel it is important to emphasize to the mill operators the dangers of poor operation, and the possibilities of groundwater contamination by seepage, and damage caused by accidental discharges. We don't feel that the people who operate these mills are really aware of what can happen if there is an accidental discharge, or if they fail to put their wastes into a properly designed lagoon. I would like to invite the A.E.C., therefore, to work with us and the Public Health Service. We have engineers, scientists, and as I pointed out, would be very happy to work with you. We would like to have copies of your reports. We would certainly be glad to make any of our data available to you, and I believe among the three agencies we can produce uranium and still discharge our wastes in a safer fashion. Thank you.

MR. STEIN: Thank you, Mr. Caldwell. Are there any comments or questions?

MR. MARX: I just have one comment here. I just wonder what happened to the Presidential Congressional directive to all Federal agencies to cooperate with the State water pollution control officials.

MR. STEIN: It is still in force.

May we next hear from Utah, Mr. Lynn M. Thatcher.

MR. THATCHER: I have a very brief statement here that was adopted by the Utah Water Pollution Control Board. To save time, I will read it hurriedly.

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We wish to express our appreciation to the U. S. Public Health Service for the development of the Colorado River Basin Water Quality Control Project, from which we expect to receive much valuable information. As mentioned previously, there are indications already of contaminants in the waters in question which exceed suitable limits. More specific information is needed on these contaminants and on all others which could become a threat to water quality.

We would like to urge a rapid expansion of the water quality control project to encompass studies of all important characteristics of water, including in particular those physical, chemical and biological characteristics to be covered in the new Public Health Service Drinking Water Standards, as well as others which could result from industrial waste discharges. Even though many constituents may not pose a problem either at present or in the immediate future, we believe it is important that accurate baseline information on present constituents at all river stages is essential, and that the quality control project should include plans to start accumulating such information at the earliest possible date.

River sampling points must be selected with the object of making the desired information of greatest value, particularly with respect to defining water quality at state lines and pinpointing sources of contaminants, whether natural in source or otherwise. With this in mind, it is our belief that an additional basic data station should be established on the Green River near the Utah-Wyoming border. The need for others may become apparent as the study progresses.

It is further suggested that serious study should begin at once on the question of how pollution assimilation capacity of the river system should be apportioned among the various states. The need for this is inherent in any program which is aimed at establishing acceptable levels of pollutants, and enforcing pollution controls designed to achieve such levels.

It is hoped there will be a continuous flow of all pertinent information from the project to the states involved, and that the past policy of keeping individual states informed of project activities within their borders will be continued.

That concludes my statement. I wonder, Mr. Chairman, if I should proceed now to call on Utah's invitees to this Conference.

MR. STEIN: Yes, go right ahead.

MR. THATCHER: Utah has taken the position with respect to this Conference procedure that they should invite everyone who will in any way have an interest in the pollution problem, and make the further effort to see that they have an opportunity to make a statement at the meeting. With that in mind, I would like to go through our list by categories and ask that when I name each category that if there is any one here in that category, they rise and identify themselves and indicate whether or not they would like to make a statement.

Before I start on this, there are two or three here that I have already recognized. These are people from the uranium industry, and I will call on them first. I would like to ask Mr. Travis Redman, of Texas Zinc Minerals, if he would like to make a statement.

MR. REDMAN: Mr. Stein, gentlemen. I am delighted to be here, and I appreciate Mr. Thatcher's kind invitation. I am called Assistant to the President of Texas Zinc Minerals Corporation. Texas Zinc is a subsidiary of Texaco, who pays my salary, and New Jersey Zinc Company. We have been in business about five or six years, and are a licensee of the A.E.C. I spend a great deal of my time trying to figure out how to get enough ore into that mill to keep it going, and then spend the rest of my time worrying about how to get rid of the wastes that we generate. We have many problems. Everybody has problems. Ours, of course, are more serious than anybody else's, because they are more immediate.

I'd like to mention the word "industry". We have been talking about industry, and apparently this Conference has to do greatly with the pollution of the Colorado River by the uranium industry. This industry is a little different than the fellow who makes shoe strings, or something like that, because we are all working together. We are a part of the Government, actually. We sell our products to the A.E.C. They are the only people we can sell it to, right now, so I wanted to get that pretty well cleared up.

We work like the dickens to try to abide by all of the rules and regulations that are thrust upon us, and we in industry like to think we have helped to formulate some of these rules. When we first got started, and negotiated our contracts -- obviously, we have to make a profit and justify our existence, just as you gentlemen do here, or else they wouldn't send us to these meetings -- we were a little naive, I guess, and didn't recognize how much time and effort and expenditure of money was going to be necessary in order to protect the population. Our company has recognized the problem, and we think we are complying with the Division of Licensing and Regulations, which is the agency to whom we report. We have also been extremely active in most every phase of the radiation health business. We were fortunate enough to serve on the committee with Duncan Holladay, of the Public Health Service. We were very happy to have put together an American Standards Association standard, as it is called, dealing with radiation problems in mines and mills. We try to come to all of the meetings that we can. We are trying to learn your problems. I assume that most of you gentlemen have visited a uranium mill. If you have not, I certainly heartily recommend that you do so. We couldn't accept all of you at Mexican Hat at one time, but we would be delighted to have you. In other words, I don't believe in trying to talk too authoritatively about something that I don't at least have a vague working knowledge of, and I must admit I don't have too good a knowledge in this field here, but I am trying awfully hard, for our company.

As far as problems are concerned, we have a water problem at Mexican Hat. Either it is too thick to drink, or there is none at all. And if there is anybody here who can tell me when the river is going dry this spring, I would like to know it!

We deal with Mr. Thatcher's organization, most delightfully. We deal with the A.E.C. We have winds to contend with. As a matter of fact, we pride ourselves that in heavy dust storms some people come into our crushing and sampling plant to get out of the dust!

I think that's about all I have to say.

MR. STEIN: Are there any comments or questions?

MR. THATCHER: Thanks, Travis. It is comforting to find out that the Utah Water Pollution Control Board doesn't have all the problems! I wonder if we could ask Mr. B. B. Winn, of the Uranium Reduction Company, Moab, Utah, if he has a statement.

MR. IZZO: This particular B. B. Winn is called Ted Izzo, from the Uranium Reduction Company.

I would like to start by saying that uranium mills have not been blindly and blandly discharging horrible radioactive wastes into the Colorado River watershed. In 1959, the Uranium Reduction Company started a kind of Colorado River survey of its own, encompassing some hundred miles of Colorado River, as well as the Dolores and Green Rivers. We take samples on some 15 points on these rivers. Some of these points are accessible only by boat, and I know we have samples from some areas that your boys haven't covered yet. We assay these samples for uranium, thorium-230, and radium-226. We also assay our effluents for these same constituents, as well as 12 other chemical assays. The results we have to date on the river are in substantial agreement with the data presented by Dr. Tsivoglou, and with data presented by others.

One of the things we have at Moab that other people don't have, and some people would not consider it as an advantage, is an average of about three million gallons per minute of Colorado River water flowing past the operation. This gives us a dilution factor of some 2,500 to 1. As Mr. Anderson stated, probably rainbow trout take to our effluents rather well, too.

Another couple of things that have happened at Moab --

In 1959, the entire mill process was changed. Although the radioactivity level of the effluent was not the major consideration in this change, it was, nevertheless, a major factor. This change in the process reduced the thorium-230 levels to well below the current specifications. Of course, the uranium levels are always below the specifications,because we like to put the uranium in the can. The radium-226 levels we regard as very low in our effluent. Another change that was made was the introduction of another settling pond, to which the tailings pond effluent goes before discharge to the river; so as I stated, I will say the uranium industry, and particularly the Uranium Reduction Company, is not blindly and blandly discharging radioactive wastes to the Colorado River.

MR. STEIN: Thank you.

MR. LONG: Where did he say he was taking samples on the Green River?

MR. IZZO: We go down the river in a boat. We bought a boat for this purpose. We take a sample of the Green River just above the confluence. We take another sample just below the confluence. This is the only sample of the Green River that we take.

MR. LONG: But that is in Utah?

MR. IZZO: That is in Utah.

MR. STEIN: Are there any other comments or questions? If not, thank you very much.

MR. THATCHER: My apologies, Ted, for that blunder of mine when I called on you. Are there any other representatives of the uranium industry? Mr. Bob Beverly, of Union Carbide is here. Would you like to make further comments?

MR. BEVERLY: Your problems should be minimal from now on at Green River, Utah. That mill was shut down in February of this year.

MR. THATCHER: I'm not sure we recommend this method, but I agree it solves the problem.

I have not recognized any other invitees in the audience from Utah, but just to be sure that everyone has a chance, I would like to hurriedly read over this list; and since I will be doing it hurriedly, will you please interrupt me if you are represented in any of these categories.

First, city officials. I had an indication that a representative of Ferron, Utah, would be here. I wonder if we have anyone from there. Any county officials from the State of Utah? Are there any State agencies from Utah that we have not heard from? Dr. Sigler, are you in any way representing Utah State University? Is there any statement you would like to make? I presume that the University of Utah, and Brigham Young University are not represented; I don't see anyone here.

Associated Civic Clubs of Southern Utah. Utah Wildlife Federation. Utah Manufacturers Association. Utah Mining Association. Utah Dairy Products Association. Dairy Council of Utah. Utah Dairy Association. Utah Poultry Association. Utah Wool Growers Association. Utah Canners Association. Utah Water Users Association. Farm Bureau Federation. Portland Cement Association. Utah Mosquito Abatement Association. Utah Association of Petroleum Retailers. Rocky Mountain Oil and Gas Association. Utah Petroleum Council. Are there any representatives of the dairy industry? Meat packing industry; steel industry, oil industry, coal industry, gas industry, drilling industry. Do we have representatives of Texas Gulf Sulphur Company, or San Francisco Chemical Company? Utah Power and Light Company; Upper Colorado River Commission -- Mr. Paul Billhymer represented this association at the Phoenix Conference. Are there any other industries or interested persons from the State of Utah who would like to make a comment?

Thank you, Mr. Chairman.

MR. STEIN: Thank you, Mr. Thatcher. Are there any comments or questions on Mr. Thatcher's presentation? If not, we will go on to Wyoming, Mr. Frank Long, of Buffalo, Wyoming.

MR. LONG: Mr. Chairman, and members of the Conference. You know, I come from a big State with few people, but it happens that the Colorado River drains about one-quarter of Wyoming, and in that quarter we have a lot of industry. I could go on -- I have a speech here, Mr. Chairman, that could go on about half an hour, but I will hit just a few high points.

Wyoming ranks third in the production of crude oil; seventh in the production of natural gas; second in uranium -- and we don't have any trouble with the boys in the uranium business. We rank fourth in coal, first in trona, and first in bentonite in the whole country,so that gives you an idea why we have these industries. About a quarter of these are in the part of Wyoming drained by the Colorado River, and the reason we are getting all these new industries is that we have no corporation income tax, no personal income tax, no gross receipts tax, no excise tax, no severence tax, no tax on intangibles, no general bonded indebtedness; we have practically no inheritance tax. All we have, you might say, is the 2% retail tax.

A lot of people don't realize about the trona. It's quite an industry, and is practically all coming out of the southwest district. Just recently, the Food Machinery and Chemical Corporation, with U. S. Steel, put in at Kemmerer a three million dollar plant to develop metallurgical coal from low grade western coal. Every one of these industries uses water. We have five uranium mills operating in the State of Wyoming, and are about to put in two more, and we don't have a bit of trouble with pollution from these uranium plants. Our oil men and oil companies have cooperated with us 100%.

One thing that is new in Wyoming is that our State is becoming a playground of the United States. We have a great tourist influx for fishing, hunting, and other recreation. When we get the Flaming Gorge Dam filled, we will have a perimeter of 150 miles within the State of Wyoming right next to Route 80 of the interstate highway. With the Bureau of Reclamation and the Park Service, our water pollution council is going to have to work out a plan for handling that. There is a little Reclamation reservoir on the Big Sandy River at Eaton, and on week-ends they have to have a traffic officer out there to avoid a traffic jam with the boats.

We members of our Water Pollution Control Advisory Council are getting along fine. We don't want to cause any pollution in Wyoming, and I hope that in the future we won't.

MR. STEIN: Thank you, Mr. Long. You know, I have been reading a series of articles in the New Yorker, on Texas, and it is noted in there that they are in first place in natural gas production. I note that you did not dispute that claim!

Are there any comments or questions on Mr. Long's statement? If not, we will now throw this meeting open for discussion on any points anyone may want to bring up.

MR. FLICK: I am Bob Flick, of United Press. We represent a majority of the newspapers in the seven Western States, and I would like to know two things. First, will there be a similar Conference next year, and where; and second, could I ask you for a summation after what you have heard as to the major problems or progress which will be undertaken in the next year of your work?

MR. STEIN: There will be another Conference within a year. The Conferees will have to decide that. Where we will have it will have to be decided by the Conferees also.

We will get to the summary right at this point. Are there any other questions or comments? If not, maybe we can try this. If it doesn't work, we can go over it again. Perhaps we can try a summary and a discussion of the summary points at the same time, in order to save time. Let's try it, and see if it works.

The first point, I think, deals with radiological findings. The statements here, and the discussions, have indicated that there has been considerable reduction of environmental contamination from uranium milling wastes during the past year. This trend must be continued as far as possible for the protection of the users of the waters of this Basin. The great reservoirs of the Lower Colorado Basin have been shown to be the long-time resting place of these radiological wastes, and it has been pointed out that these reservoirs are the only reasonable source of water supply for many of our large municipalities in the Basin, such as Las Vegas. Therefore, at all costs, the water quality of these reservoirs must be protected.

Certain radiological problems still remain. They involve contamination of crops at a small number of farms using polluted river water for irrigation purposes, and one tributary system that contains undesirable quantities of radium. None of these problems involves an immediate radiological hazard. I would suggest, and I think it very well may be the concensus of the Conferees, that efforts be made during the next year to see if we can clean up the situation, in these specific areas, both with the crops in these small areas and the three dry washes which remain, to have a relatively definitive report next year as to what the hazard is, whether there is any feasible method of treatment, to try to get remedial action underway and get a prognosis.

The next problem we have come to in radiation is that of accidental spills of pond liquor from uranium mills into the waters of the Colorado River Basin. It seems that this requires the development of adequate measures to preserve the water inviolate. I think this goes to two points. One is this. We should have a criteria developed for tailings ponds which will provide a safety factor, and to all possible extent preclude the accidental spills. I would suggest that the Public Health Service, in conjunction with the States, A.E.C., and other agencies: 1) develop criteria for those ponds during the next year; 2) take all active measures to see that they are put in force; 3) to come up with a specific report by next year on each and every uranium milling pond to see if it is, in the opinion of every regulatory agency concerned, both Federal and State -- to see if they meet the criteria.

And again, we know what the problem is with the best of man-made devices. We are dealing with men and machines. We should install a system that if there is a break-through, either man-made or machine-made, there should be a standby alerting system where particularly the State agencies can be informed that a break-through has taken place, so remedial action can be taken. In very many of these cases the stream flows can be calculated, the water intake can be cut off at downstream communities using the river for water supply until the slug passes. This is something that should be worked out and put into effect as soon as possible, and I don't think we have to wait for the development of criteria before we put into effect this alerting system.

Are there any questions or statements of problems there?

MR. KAGAN: I am Harry Kagan, Chemist with the Department of Health, State of Nevada. I would like to make this point. In this area where there is high radiation in foods and fodder, people or animals eating of this will accumulate this. This is accumulative, so it may be a deeper problem than what first meets the eye. The radiation we eat three times a day as humans, and animals forage most of the day, so this would be an accumulative problem, and it should not be glossed over too lightly; it should be kept in mind.

MR. STEIN: We recognize that. There were certain points -- and I think the record is clear on this. I think we will take cognizance of this. In the Animas River case, while there was a measure of radioactive material in the water supplies, for example, of Aztec and Farmington, New Mexico, the real impact, it seemed to us, would hit those ranchers who were getting water from those irrigation ditches. And you know what happens with farmers better than an Eastern boy like myself; they do what comes naturally, and go to the irrigation ditch right close, rather than head for the approved water supply which might be miles away. Furthermore, they are dependent for their meat and their grain, on the produce and stock grown right on the premises to a large part, and don't go to the supermarket and get it from somewhere outside. We recognize the strong impact that this radioactive and contaminated material has when it hits these people. These, of course, are the key people to protect.

I am just going through these points, which will appear in a somewhat more logical order in the summary, but we will hit them just as they come up here. The next point is that we must take cognizance of the fact that the collection of data necessary for developing a comprehensive pollution plan for the Basin has been indicated.

MR. BONDERSON: Mr. Stein, could we go back to the radiolocigal summary? There are a couple of points that I would like to discuss. Number one is that you made reference to the in-basin use of the Colorado River, and made specific reference to Las Vegas. I think your summary should also very clearly show that outer-basin people are dependent upon this to the tune of approximately ten million people.

MR. STEIN: Yes, I think that is a very good point.

MR. BONDERSON: Number two. You have indicated that there has been a clear improvement of the discharge situation from the uranium processing industry in the past year. I have nothing before me to substantiate this. I am not bright enough to assimilate all the data that was presented to me this morning. I will accept that statement, if this is the conclusion of the staff of the Public Health Service, but I would like to make it clear that I have nothing before me to prove this.

MR. STEIN: O.K. Let us check that again. May I call on Dr. Tsivoglou for a statement on that?

DR. TSIVOGLOU: I think maybe we have lost sight a little bit of the facts that Mr. Sponagle presented earlier. We regret very much that there are not written reports available at the present time, but we wound up in trying to get our work done,and not receiving the bulk of our radium results in the last month, and have not had time to put this into a formal document. Mr. Bonderson's point is well taken. We expect to have documents very shortly.

MR. STEIN: Rather than take this on faith, Ernie, and I think Mr. Bonderson does have a point, could we say that on the basis of the information received here our studies show a considerable improvement in the streams from a radiological viewpoint? Would that be agreeable?

DR. TSIVOGLOU: Without any question, that is true.

MR. BONDERSON: Very good. One last point. The terminology you use in your final summation here, as it relates to what the needs are for the following year in relation to this subject -- I think we should make it clear that these are immediate needs, and do not reflect nor infer that no long-range problems remain. This must be very clear.

MR. STEIN: Yes. That will be clear. These are the immediate needs, and I think we should get a statement on the long-range needs.

MR. BONDERSON: Fine. Thank you.

MR. STEIN: Are there any other comments on that aspect? If not, we will go on to another, and that is that in the collection of data necessary for the development of the comprehensive plan for the Basin which has been initiated, considerable gaps in available knowledge, especially in regard to industrial water use and waste discharges, have been noted. Now, detailed analysis of data has been made, and an economic study is being designed to evaluate present and future economic aspects of Basin development. I think during the next year we should take it as our task to be well under way with the initiation of this economic development. I think we should also call upon all industries in the Basin to make available knowledge and data to the States and the Federal agencies, so that we may get a complete picture of what is happening in the Basin, both from a comprehensive viewpoint and public relations viewpoint. This has always proved to be the best policy.

MR. SAMSON: Just as an outside observer, with no official status at all, I noted Mr. Thatcher's remarks about all of the industries and all of the personnel he had apparently gotten in touch with in connection with this hearing. I think this is real fine. I was just wondering whether you or any one in the Public Health Service had been in touch generally with the other interested industries in the area, and advised them and asked them to come in?

MR. STEIN: That is a very pertinent question. I think that at the First Session the sentiment of the people was reflected, and it was readily agreed that the first order of priority was getting at the radiological aspect of the problem. I think we have done a lot at this meeting to set that into perspective. But obviously, that is what the people were immediately concerned with. Therefore, with the start of the study, and staffing and putting into operation the laboratory and so forth, the one segment of industrial development which was concentrated on during the first year was the radiological aspect. This will be expanded in future years. I suspect that during the second year we will move forward to other industries.

Another point has been that biological tests have shown that some of the uranium milling wastes discharged to streams are toxic to fish, and that bottom life has been greatly reduced in two of the river systems of this Basin. For the next year, we should take action on a mill-by-mill basis to reduce the toxic effects from uranium milling operations so as to abate pollution from this source. I think that the Animas case, and the case of the mill at Durango, has shown that with a little attention to detail and the will to do it, this can be done. I think we should have a complete and detailed report at the next meeting; and I think we should set that as a target date to completely clear up the problem by next year.

MR. IZZO: I think in your summation of that particular point, you should make the point that these effects are not radiological effects.

MR. STEIN: I fully agree. They are non-radiological and chemical effects. Let us make this abundantly clear. The pollution effects caused by this type of waste are not within the jurisdiction or the responsibility of A.E.C. If anyone is responsible for correction of these wastes, it is the States and the Public Health Service. The A.E.C. has been under fire a little bit here, but this is not their job, and they can't be criticized for this. These are the kinds of industrial wastes that we would expect to meet in any pollution situation. The State water pollution control agencies are primarily responsible, with our backing up, to see that this is done. We set our goal for next year to try to see that we have really got this problem under control.

MR. BONDERSON: Mr. Stein, does that conclude that section?

MR. STEIN: Yes.

MR. BONDERSON: I'm sorry, but I feel compelled to raise another question. Are you suggesting that this group, through the facilities of the Public Health Service, will take enforcement actions on these areas where there have been fish kills or biological adverse effects?

MR. STEIN: No, sir. Again, this question of enforcement action is imposed. I think we are in what we would term an enforcement action now. We would expect in this case, as in all other aspects of the case in dealing with the uranium milling industry, that there would be full cooperation among the industry, the States, and the Federal Government. We have had no problem. I don't look for what you would generally term an enforcement action. Our policy has been to measure our success by the pollution control we can get around the conference table, rather than going to a hearing or a court of action. Now, certainly, in dealing with the uranium milling industry, there is nothing to indicate that we will ever get beyond the conference table.

MR. BONDERSON: I would wonder about the particular wording of this summation. That is, if there are no adverse effects in a downstream State other than that in which the pollution occurs, I wonder if it wouldn't be appropriate if we stated that the Public Health Service, working through the State --

MR. STEIN: I thought I said that. I think the record will show that the abatement of this problem is the primary right and responsibility of the State -- interstate as well as intrastate. Now it is very, very clear that we intend to work through the States. If that was not clear in my previous statement, that is certainly what was intended. I don't think we have any difference of opinion here.

MR. REDMAN: Mr. Stein, in reading from last year's report, there are six objectives, and the last one says, "And last, but not least, the uranium industry" -- other industries kill fish too, and I think you should be a little more specific, a little more broad about this, and don't imply that the uranium people are the only ones at fault.

MR. STEIN: No. I think we will agree that other industries kill fish. The problem that we have here, and for other reasons we have stated certain priorities and have made examinations of these uranium mills. And I think it is just sound administrative practice among the States, that when you move or focus attention on a particular source of pollution, you try to clean up all the pollution effects from that source. Now,I thought I made that clear. Again, the killing of fish is not a prerequisite of the uranium industry. This is the kind of general pollution effect we have experienced from many industries and municipalities in the past.

MR. REDMAN: But we keep coming back, and the word "uranium" keeps rearing its ugly head.

MR. STEIN: Yes, I think that is true.

MR. BEVERLY: I am Bob Beverly, of Union Carbide Nuclear Company. Because the United States Public Health Service has taken the responsibility of calling these last two Conferences, and because industry is so vitally concerned about these reports, I wonder what the Conferees would think of having the Public Health Service officially invite the industries concerned to these meetings. Certain States have been very cooperative in notifying us. However, I think all industry should be informed. I believe our industry in this case is rather conspicuous by the few people involved here, and I think part of it is due to the fact that the other industries were not officially informed and advised about it.

MR. STEIN: I am glad you brought that up, and I don't want to sound like a bureaucrat. We are all governed by our law. We heard Mr. Bonderson, and he had a very valid point which he wanted emphasized. That is about the primary rights and responsibilities of the States in this field. Mr. Bonderson and the States made the same representations before the Congress when the law was enacted. We agree with him on that.

In framing the law, however, the Congress provided that this was a Conference between the Public Health Service and the States, and they left it to the States to invite these people -- industry people and anyone else. In essence, the law is written in such a manner that it is up to the States, and if the States wanted to meet with us in a bare room, the States could do it. The States have never done this, and it has worked out very well. Our limitation is one of law. We take every effort to encourage the States to invite everyone possible to invite. I think you can see from Mr.Thatcher's list, he made every effort to do this.

MR. WILLETS: It is not clear to me as to whether the uranium industry considers itself subject to State authority. They agreed readily to meet A.E.C. regulations. It has not been clearly stated by anyone here that they are subject to any State authority.

MR. STEIN: Well, now I know this is a vexing question. If they want to get into it, they can, but I don't know that we can solve this here.

MR. WILLETS: But isn't it idle to state that the States should exercise authority? Do they have it?

MR. STEIN: We think it is clear, and I am only speaking for us, that we believe the Public Health Service of the Federal Government has authority to abate pollution of interstate streams endangering health or welfare of persons in another State from whatever the source. I don't think that is disputed. However, we also agree that the primary rights and responsibilities to abate that pollution rests with the States. If they decide that they have a particular situation which the State cannot handle, and they want us to help, I think we have the authority.

As to this other question, I am not sure this is a good place to go into this discussion.

The next point we have is that the Public Health Service will propose a radiological monitoring network of about thirty stations, to be initiated. Will we be able to get that into effect by next year?

MR. SPONAGLE: Yes. Work on that will begin next month.

MR. STEIN: We are also, as has been indicated, constructing a laboratory in Salt Lake City. The primary function of that laboratory will be to service this Project. This laboratory will be completed this fall, and full scale laboratory operations will be started on this work.

MR. MARX: Mr. Chairman, will the specimens from the more difficult analyses from the States be accepted by this laboratory?

MR. SPONAGLE: As long as they are related to water pollution, I think this can be worked out.

MR. STEIN: I think primarily that our laboratory will be to service this Project. As in all our functions, our job is to work cooperatively with the States, and we will try to make the full facilities of that laboratory available for a variety of purposes. As you know, the new legislation in Congress contemplates setting up a series of laboratories to do just that, and we may be just a little ahead in this area.

The next point to be taken up is the problem of the Yuma,Arizona water supply. I think cognizance is taken that Yuma, Arizona had to abandon the Colorado River as the sole source of water supply. Again, I recognize the difficulty of the problem involved. There are very few problems that the Public Health Service gets into on pollution that don't seem impossible when we get into them, because if they weren't impossible, the Federal Government probably wouldn't get into them. But I have every confidence that an amenable situation can be worked out in this area with full protection of all agricultural, industrial, and municipal interests involved. I think we should set as a priority for the Public Health Service and the States involved and the other Federal agencies, working out a solution to the Yuma, Arizona problem. I don't think we have to wait until next year's Conference to put that into effect. Hopefully, the solution can be worked out by next year, and we should have a report on that. And this should be one of our top priority items.

MR. BONDERSON: Mr. Stein, another comment on that situation. I don't wish to appear to be minimizing the Yuma problem; this is very serious. This group was assembled to study basin-wide problems, and has embarked on a very massive, long-term program to accomplish two principal objectives. I think we will find that year after year there will be situations developing comparable to the Yuma situation, and I don't think it would be appropriate to cast this Yuma situation as a high-priority one as it relates to the total Project. Rather, it should be classed as top priority in a corollary field so that we won't over the years to come possibly jeopardize the basic objectives by concentrating too much on these corollary problems of an immediate and pressing concern.

MR. STEIN: I would agree here, and I think this -- we had several comments on this, and I think we should bring this up. There is an immediate problem, and a long-range problem, in the whole Basin. Now,what we are trying to do is assess priorities for a series of immediate problems which we can absorb while we are proceeding with our long-range study of the region. I don't think these are entirely incompatible. Secondly, I think what we are dealing with here -- and several people have brought this up -- is that while we are doing the study, as we go along, we will try to use our resources to achieve remedial action wherever we see fit. Now, this isn't a question of priority. I think that if the effort to handle this Yuma problem would in any way deter the moving ahead on the over-all river basin project, we would have a problem. However, I don't see that. If it is so, please let me hear it.

MR. SPONAGLE: No. You are right, Murray. I think this is a study that will not substantially affect the meaning of our long-range objectives. We would like to point out too, that in this situation and any others which should come up, there is a good deal of knowledge to be gained concerning our long-range objectives, and thus if we can build up information on a series of such incidents, this will be of great value to us.

MR. MARX: I think probably too, Murray, that this may not be such a big problem, as a matter of conferencing. It is a serious situation, but I think it can be cleared, and it may take only accomplishing a few studies and some decisions to make.

MR. STEIN: That's right.

MR. GAHR: Mr. Chairman. George, isn't the data pretty much available right now? You understand what the problem is, and can't it be worked out within your own State? Must it occupy this Conference?

MR. MARX: Yes. It is a matter of the City and the Arizona Water Company, the Reclamation Service, and the State of Arizona getting together on this thing with the Public Health Service's help, and we can take care of it.

MR. STEIN: Yes, I think it puts it into perspective as to what we are going to do.

MR. MARX: It is not going to be any long-range problem that's going to take a year or two. It will be left up to the local community to decide for themselves what they are going to do. The long-range problem is the other one, though. That's the one where the Colorado River is being degraded, and it is going down into Mexico.

MR. STEIN: That is right. Now, let me point out the technique of what is going into the summary. I am throwing out these points as they were put up. Each one appears to have as much significance as the other, because they are coming up chronologically, but we are discussing them all, just as they come. This does not mean that some of these things are not just small things of immediate concern, and some are long-range problems.

MR. GORDON: Just as an observer, sitting here listening to you gentlemen trying to get together on this summary, Mr. Marx raised a question which some of you have been trying to avoid, I suspect. As I understand it, we are working under a treaty with our neighboring country with reference to the division of the water supply of the Colorado River. They are entitled to so many acre-feet, and we are supposed to have so many acre-feet. Is there anything in that treaty that says anything about the quality of the water? Another thing that has worried me as I have sat here, is this. You have been worrying about the intake at Yuma, but do I understand that Yuma has a good, modern sewage treatment works, and is sending our neighbors water fit to use down there, or are we sending them what we don't want?

MR. STEIN: I'll answer the first part of the question, about what is in the treaty. I don't think there is anything specifically about water quality in the treaty; however, I think that is within the jurisdiction of the International Commission to take up and to work on.

MR. IRELAN: My name is Irelan, and I'm with the Yuma-Colorado project. I'd like to make a comment on the treaty, because I happened to read last week a summary report regarding the treaty and there was a statement in it about a Mexican negotiator who stated that they felt like they were entitled to a certain amount of water in its original quality, which would be an extremely hard thing to do, since everything has been done to the river. But it would be hard in an international court for somebody not to find for Mexico. That is the thing you would be up against. You can't dump all the refuse on Mexico, and get away with it. If they should go to court, it is an extremely difficult problem. Something will have to be done before that water quality becomes too bad for them to use.

MR. GORDON: My only reason for raising the question at all is the old saw that if you want good neighbors, you must be a good neighbor yourself.

MR. STEIN: Right. Do you want to answer the second part of that question, Mr. Marx?

MR. MARX: No. But to reiterate what I said last year -- Yuma does not have a treatment plant. Yuma dumps raw sewage in, and it goes down to Mexico. It doesn't affect anyone in our country, but don't forget, they use that water to irrigate vegetables which come back into our country.

MR. GORDON: In some parts of our country, I know that certain areas have been black-balled on certain types of vegetables temporarily, until they cleaned up.

MR. WILLETS: I am Dave Willets, of the California Water Pollution Control Board in the Imperial Valley. We have run into the international problem there. Mexicali is dumping their sewage into the New River, and we are trying to get them to clean it up. We're dumping it into them, and they're dumping it into us.

MR. STEIN: On this point, I would like to have the advice of the Conferees and also the staff. The suggestion was made that during the next year we initiate a study of the boating situation on lakes. Do you anticipate that, or can that be done?

MR. SPONAGLE: I think we might get into that. Right now, it is a little difficult to foresee just how much time and effort will have to be spent on the numerous things already proposed for the next year.

MR. STEIN: In any event, I think maybe we could put it this way, that either we get started on this problem, or next year in your report to the Conference we have pretty detailed plans on when you are going to get started; or if you have started, what you have done and where the program is going. That should be covered.

MR. COULTER: Mr. Stein, I'm Mr. Coulter, from Washington. As you well know, I spend much of my time trying to rectify bum policy decisions, so let me speak up before we make a mistake. In the Technical Services Branch in the coming year we hope to get a study under way that will take on in a rather grand scale the problem of utilization of water supply reservoirs for recreational purposes. I don't know whether we will get into Mr. Thatcher's problem of ski slopes, as well as the reservoirs, but we do have a study pointed toward this on the books, and rather than get this comprehensive study all mixed up with that special study, perhaps we had better try to develop it from the special study standpoint.

MR. GAHR: It is my understanding that many of the States are quite busily at work on recreational things which include boating. I believe we would be well advised to get more information on this special study and how the States might work together on this problem before we give this charge to the Colorado River Basin Project.

MR. STEIN: Can we have a perspective report on that by next year?

MR. HENDERSON: The Sanitary Engineering Center has been working on the pollution effects of recreational boats on lakes. Perhaps these studies may be applicable to the problems in the Colorado Basin.

MR. STEIN: I think then, as I get the concensus of this, we will have this at least covered in next year's report. And I don't think the policy conditions can be too bad, since Coulter spends most of his time rectifying mistakes, for during the last year he hasn't been down for any overtime!

We have the California comments, and let's see if we have covered these. One, I think, has been covered previously; that ten million people in California outside the Basin are dependent upon the Colorado River for their water supply. We also will make it very clear that one of the key points of the study is to be geared to the long-range effects of radioactive pollution. This is what we are driving for, and that will obviously be an over-riding consideration.

Next, I think we have also covered. I think we should, through the States particularly here, try to get industries to submit detailed reports on what they are doing; and hopefully, next year, be pretty adequately represented by not just one industry, because there are a lot of industries distributing this and probably contributing to the wastes of the Basin, and we are probably giving this the wrong perspective. I think it would be wise for all concerned if we could get a more detailed industrial analysis by next year.

I think also that we should agree that we will make reports available and put the raw data in circulation. I don't want to pin the Project people down unless you want to do this, but the suggestion was at least on a quarterly basis. Would that be an undue burden?

MR. SPONAGLE: I think the network data will lend itself very well to this. We expect to be collecting samples and have analyses monthly.

MR. STEIN: Can we say that insofar as possible we will do this on a quarterly basis?

MR. SPONAGLE: Yes. As far as possible.

MR. STEIN: Again, the suggestion was that the studies be directed, right at this stage of next year, to the development of water quality standards, with maximum emphasis on water quality management, in the Basin. Possibly on next year's report we should emphasize the progress in that direction, where we are going, and possible conclusions for the Conferees to reach.

The point was made by Colorado as to the need for study within the States concerning water quality. I think within the resources of the Public Health Service, we would be glad to provide any assistance on request, as it is our policy to do that. In addition, we would like to have the results of those determinations put into this general picture. I'm sure that the experience in the various States of the Basin will be applicable to other groups. If the States would ask us for assistance on that, within the States, we will give that full consideration.

The data will be made in the form that will be most useful to the States. I think this can best be done by consultation, whether on a State or river basin basis, and in the form that the State will find most useful to deal with in their own State. I think the conclusion of the Conference can be that the Public Health Service staff will get together with the States before the data is put out, and get their suggestions and review of your format in putting out data, to try to make certain that this data will be in the most useful form they can utilize.

The next problem we had, and this was from Colorado, was the study of oxygen levels. Is this contemplated in the next year?

MR. SPONAGLE: We have talked about this, and I think we will be getting into it in connection with the study we expect to begin very shortly, and which Mr. Pahren mentioned this morning. The study in a small sub-basin will certainly include this. As to whether it will be possible to go into any large scale study of oxygen capacity, I don't know. The resources are being strained this year. This will depend upon finishing the priority items and seeing how this can be scheduled. This is certainly something we do want to consider, and will have to consider in the project as a whole.

MR. STEIN: In any event, next year we should have a report on whether we have initiated the oxygen studies, or the prognosis as to what we intend to do.

The next point was made by Nevada. It is a key point, and goes into the next point, which I might mention first. That is, that we are to have this over-all study concurrent with the program of correction and prevention of pollution. We are operating on two levels here. This is what we have to keep in mind. The point is that Lake Mead must be preserved as a source of water supply for the city here. If any corrective action must be taken, this should be considered next year. Again, this is one of these action points which must be settled.

New Mexico made the point on dealing with nitrates in the underground water supplies. Will we get into that at all this next year?

MR. SPONAGLE: We are hoping that we can. We plan to have a groundwater geologist on our staff. We do not have one now. We are looking for one. As soon as we locate a suitable candidate and he comes with us, we will have these studies begun.

MR. STEIN: Then the conclusion can be that we urge you to begin these underground water studies, and we hopefully will expect a report from you next year on this.

MR. LONG: Mr. Chairman, on that underground water supply, does anyone know what the oil well flooding of these wells will do to that?

MR. STEIN: Do you mean re-charging?

MR. SPONAGLE: I am not familiar with that.

MR. LONG: You know, they are doing that now all over Wyoming and Louisiana.

MR. STEIN: Oh, yes. I am not familiar with your situation up here. You people from California are probably more familiar with it than I am. But the re-chargers down in the Louisiana, Oklahoma, and Texas regions are re-charging into levels which are not used for water supply. They are much below that, and of course, the re-charge in very many cases is brine, though sometimes they use fresh water if it is economical. Once they put it down there, that's not useful water supply any more. I don't know what your situation is in this part of the country, but I don't think it is an incompatible situation, generally speaking.

The next point, raised by New Mexico, is the question of dilution factors available in the streams. Will that be entered into at all?

MR. CALDWELL: We pointed out that we think it might be wise for the Public Health Service, the Bureau of Reclamation, and the States involved to consider a minimum dilution factor in the Animas and San Juan Rivers to protect the water quality downstream. We do feel that is quite important.

MR. STEIN: This is with reference to particular river basins. I don't know if this can be amenable to the whole system, of course. Do you think that this can be worked out? Now again, this is the kind of thing that would have to be reported as it is developed, and made available to the States as soon as possible. This couldn't wait until next year to be done. This will be one of the things we will look for, dilution factors, at least in those basins.

We have already covered the criteria for construction of ponds at uranium mills.

Utah makes the suggestion that all characteristics of the water be included in the study. Is this being done?

MR. SPONAGLE: Yes, we plan on doing this.

MR. STEIN: Yes, that is part of the basic study. Another point made by Utah is that we include as another object of our study the analyses of water qualities at the State lines, and pin-point the polluters. Is this going to be done?

MR. SPONAGLE: Yes; as far as pin-pointing the polluters, certainly.

MR. STEIN: How about water quality at the State lines?

MR. SPONAGLE: I think Mr. Thatcher is referring to the basic data network stations.

MR. THATCHER: Well, not necessarily limited to that,Charlie. I had in mind all of these tributaries, and I wasn't sure it was feasible to put a basic data station on each one, but I think we still have the problem of finding out. I think the State lines are critical points in these river systems.

MR. SPONAGLE: I think this would depend on the tributary itself, the type of wastes it is receiving, and what they might be. This is a matter of determining where you can get the most return for your effort.

MR. THATCHER: That is correct, and I didn't want to tie this down to all the specific points that might come to mind now. I thought we should raise this as an important question, with the idea that we could work more closely on it later, the idea being this is our objective, rather than specifically how we are going to arrive at it.

MR. SPONAGLE: Yes, I agree with you.

MR. COULTER: Mr. Stein, Coulter again. To the point to which Mr. Thatcher is talking, there are a number of specific problems arising in the Basin here that are a part of the Division's over-all program. For instance, we have talked about the pollution of groundwater, the nitrate problem; we have talked about the establishment of water quality standards; we have talked about a number of special studies that actually are part of an integrated program of the Division of Water Supply and Pollution Control. For instance, in the use of recreational waters, the Research Branch has been doing quite a bit on the effect of outboard motors. They have also been doing some work on the disposal of sanitary sewage from boats. We hope to get a study started, as I said before, in the southeast, but it will have elements in all parts of the country so that it will be a nationwide study. The Research Branch recently held a conference on groundwater pollution, and a major study will be undertaken on ground water pollution, in coordination with the Technical Services Branch.

What I am getting at, rather than pin down this study of the Colorado Basin, and to pin Charlie to the wall to bring these things in as if they were free body studies in this Colorado comprehensive by itself, to in our summary raise these points and see if Charlie can, in the specific elements of his work plan, coordinate with the other activities in the Division.

MR. STEIN: We would certainly expect that Mr. Sponagle would coordinate with other programs in the Division, programs in the Atomic Energy Commission, and programs in the universities. I think what we are dealing with here is with a specific case in the river basin, and solutions for this river basin. This is our charge, and this is what we have to keep in mind.

MR. THATCHER: Mr. Chairman, I don't think Utah wanted to imply that we particularly care whether the Project itself does all this work, or whether they coordinate with others; but we certainly want to caution against any possibility of arriving at the end of this six-year study and discovering we didn't have all the information we needed.

MR. STEIN: Yes. Now, the next point raised, and Mr. Thatcher, at this point, positive recommendations may be premature, but Mr.Thatcher raises the point that somewhere along the line, possibly in the study, the assimilative capacity of the stream to absorb pollutants or wastes will have to be apportioned among the various States. In a sense, as I understand this, this is what we are coming to. I think that in the sense we have regulated streams out here in the question of quantity, the States are going to have to get together and decide what they can put into the streams from the point of quality, if we are going to be able to use this river right down from Wyoming to California. We certainly don't have sufficient information to make these decisions this year, but again, as with some of Mr. Bonderson's points, this is what I think should be kept in mind, because in the latter years of the study this is what the Conferees may well decide to consider.

MR. GAHR: I agree with that. I think this is going to be the end point of your whole study, and we simply wanted to point out that it isn't too early to give this a lot of thought, and it is going to have to be a cooperative proposition.

MR. STEIN: Are there any comments, or points?

MR. GAHR: I would like to make a comment as to how we can improve the coming meetings, and to point out that perhaps the reason we do not have industry, agriculture, and many municipalities at this meeting -- and I'm taking the responsibility here, because all I did was to invite the industries on that particular slope -- is that we did neglect our responsibility. I suggest that we work with them much earlier on the preparation of an agenda. The reason I say we should work on the preparation of an agenda is that these people have to be alerted well in advance, and the entire group should be excited enough to prepare quite a provocative statement. Now, we have had statements that do raise questions, but I think there is a value in alerting people well in advance, and by way of repetition, we have to make a point to bring this meeting to the attention of the various sections of industry, agriculture and municipalities, and then they, too, can plan to come to the meetings.

Secondly, we would wonder if it would be possible to get some of this scientific data. You say you are going to turn it out, and this is one of the reasons I had for asking that it be made available. One of the purposes it might serve is that it be sent by the State to these folk we intend to invite, giving them an opportunity to study it in advance of the Conference, because it is difficult to evaluate much of this material right here today, under the circumstances we have had here, which may be changed at the next Conference.

MR. STEIN: I think we would like to, and again checking with the staff, get meaningful data out to the States so they can, as suggested, get it out to the industries well in advance of the next Conference so we can stimulate this interest and get these people to attend. Will thatbe agreeable?

MR. SPONAGLE: This is not only agreeable, but we are much interested in doing this.

MR. THATCHER: Mr. Chairman, may I raise a further point on that? We sent out about four hundred invitations, both last year and again this year, and one thing I have noticed is that some of these people wonder whether they should come to these meetings. They are not sure what it means. I have tried to explain the background to them. Last year, we had a limited number of transcripts available, and a larger number of summaries. Is it in the cards at all to get complete transcripts in large enough supply that we can send the complete transcript to these people?

MR. STEIN: Yes, it is. Now, the summary is required by law -- that's why you have a larger number of summaries -- we have to put them out. I don't know how large this transcript will be. You spoke in terms of four hundred. With seven States, that's going to be a large number of transcripts. I see no objection, although I don't want to make any of these fantastic government printing agreements, because we have several rules in the government on printing materials; but if the States would get together, possibly with the staff, before we print the transcript, we will ask the States how many they need. Let's get the order together, and we will make every effort to make a full run and satisfy you all.

Are there any other questions or comments on this Conference at all?

MR. NASI: Mr. Coulter raised a question concerning the coordination of this activity with the other activities of the Public Health Service, specifically our Division of Water Supply and Pollution Control, and I concur with his remarks. I would like to mention that Mr. Thatcher, of Utah, did indicate a desire to establish a National Water Quality Network Station on the Green River on the Wyoming boundary, and I would suggest that this will be considered as a regular activity of the Public Health Service in this Region, and its relation with the Project will be coordinated.

MR. REDMAN: I raise a comment there. In a little over a year, we are likely to have that boundary inundated by the Flaming Gorge Reservoir.

MR. THATCHER: It could be adjusted either way, to avoid that.

MR. REDMAN: I would suggest that a Green River, Wyoming station would be more appropriate.

MR. THATCHER: You mean at the town of Green River?

MR. REDMAN: Green River, Wyoming.

MR. THATCHER: Well, I think this could be worked out all right.

MR. STEIN: Are there any further comments or statements?

MR. GAHR: I don't know whether this would be appropriate, Mr. Chairman, but I suppose we could move to the consideration of a place to hold the Third Session?

MR. STEIN: We would be happy to, if you would wish.

MR. GAHR: I recommend that we consider San Francisco.

MR. STEIN: This is up to the Conferees. Let's see.

MR. BONDERSON: California would be delighted to have you, if you feel it would be appropriate and fitting to hold the meeting outside the Basin.

MR. WILLETS: We can still drink Colorado River water at San Diego, or Los Angeles, or any neighboring cities.

MR. STEIN: I just raise this question with you. If you want to have industry participation in an area, maybe San Francisco is the place to go, if you all want to go there; maybe it isn't. I think we should have the meeting designed, if you want to get full participation, in the area where you will expect most of your people to come.

MR. NASI: Mr. Chairman, may I suggest that by next year we will have been under way with our new laboratory for some time, and while Mr. Thatcher of Utah has not extended the invitation, I would suggest we hold it in Salt Lake City. We could then have a formal inauguration of the laboratory as a part of the Project.

MR. THATCHER: You now have the invitation.

MR. STEIN: We have had these suggestions. Maybe we will not resolve this question at this time. Let's leave that in abeyance until next year. There doesn't seem to be an overwhelming sentiment for any one place, as there was last year. Last year when Las Vegas was mentioned, there wasn't a dissenting voice in the house! And by the way, I think this is a very good place. You know, we are always suspect in the Federal Government in going to resort places for meetings, but as you know, we get a woefully inadequate per diem. The hotel rates are cheap here; the meals are very reasonable; the conference rooms appear to be subsidized and air conditioned, and it seems to be an ideal place to hold a meeting. I would suggest we give this a little further consideration, and you people will be hearing from us.

Are there any further comments?

MR. IZZO: Mr. Izzo, Uranium Reduction Company, alias B.B.Winn. A while ago you said the summary would be available from the State agencies.

MR. STEIN: Yes, that is correct.

MR. IZZO: Is that also the way to get these interim reports?

MR. STEIN: Yes. Let me say this again. The primary rights and responsibilities for pollution control rest with the States. In order to expedite that, I think the normal relationship of industries and municipalities within a State should be with the State water pollution control agency, and I think it is to the State's benefit and to ours, to funnel this information through the States. Although sending you a transcript directly from the Federal Government may be innocent enough, some difficulties might occur, and on the basis of long experience -- and I'm a twenty-year man -- I think this is the best way to do business.

MR. BONDERSON: Mr. Chairman, I would like to move for the adoption of your summary.

MR. STEIN: Thank you. Are there any dissents? If not, so ordered.

MR. WHITE: For the record, for the State of Nevada, thank you, gentlemen, for coming here. We cordially invite you to come back again next year.

MR. STEIN: Thank you. We stand adjourned.

APPENDIX A

STATE OF CALIFORNIA
STATE WATER POLLUTION CONTROL BOARD
Room 316, 1227 O Street
Sacramento 14, California

C O P Y

May 17, 1961

Mr. Murray Stein, Chief
Enforcement Branch
Division of Water Supply and
Pollution Control
U. S. Public Health Service
Washington 25, D. C.

Dear Mr. Stein:

At the Second Session of the Colorado River Conference, held on May 11, 1961, I asked to have certain material incorporated in the record of the Conference. This material pertains to the statewide policy regulations recently adopted by the State Board.

The first item for incorporation is extracted from a paper delivered by Board Chairman A. M. Rawn at the 33rd Annual Meeting of the California Sewage and Industrial Wastes Association (now the "California Water Pollution Control Association") and reads as follows:

> "The State Board's policy can be summarized as follows, keeping in mind the principle of maximum benefit and the element of reasonableness:
>
> 1. The Board's objective will be directed toward maintaining highest possible water quality, in contrast to following a direction of making maximum use of receiving waters for waste assimilation.
>
> 2. Waste discharge requirements will be designed to achieve this objective, which means establishing discharge requirements that, without doubt, will give full protection to recognized beneficial water uses.
>
> 3. Should requirements developed under this philosophy appear unreasonable to the discharger, the

> burden of proof rests with the discharger to show why it is reasonable and proper that the requirements be made less restrictive. In evaluating reasonableness, the Board will recognize the principle of cost-benefit relationship."

The second item for incorporation is the actual regulations adopted by the Board. These are contained in the California Administrative Code, Title 23, Chapter 3, Subchapter 4, Articles 1 and 2 (section 2150 through 2155 and sections 2160 through 2171). I am enclosing a document in which Articles 1 and 2 are reproduced on page 78.14 and on pages 78.14A through 78.14D, respectively.

Very truly yours,

/S/ Paul R. Bonderson
Executive Officer

Excerpts from Rules and Regulations of the State Water Pollution Control Board, Pertaining to Statewide Policy for the Control of Water Pollution". Subchapter 4. Statewide Policy for Control of Water Pollution.

Article 1. Declaration of Policy

2150. Utilization of Water Resources. Because of the need for full utilization of the water resources of California for all beneficial uses, it is the policy of the State Water Pollution Control Board that the disposal of wastes into waters of the State be so regulated as to achieve highest water quality consistent with maximum benefit to the people and to control waste disposal so as to promote the peace, health, safety and welfare of the people.

2151. Preventive Control. Preventive control and abatement of pollution of surface and ground waters for present and future beneficial uses will be vigorously and firmly exercised with the objective of sustaining the beneficial uses of California's natural resources.

2152. State Water Development Plans. The water pollution control boards will take cognizance of any general or co-ordinated water development or conservation plan of the State in formulating pollution prevention and control plans, policies and actions. The boards will establish reasonable waste discharge requirements to protect the quality of waters developed and furnished as a part of any such plan.

2153. Waste Discharge Requirements. Requirements for all waste discharges shall preclude unreasonable harm by such discharges to other water users or resources which are dependent upon the quality of the receiving waters. The views of all interested parties, including existing and potential water users, will be solicited and considered in the setting of waste discharge requirements.

2154. Co-ordination with Other Agencies. Mutual co-operation and assistance will be guiding principles in working with other public agencies having water pollution or water contamination control responsibilities. Policies and programs of the boards will be reasonably consistent with water pollution control programs of state and other governmental agencies. The planning, investigative, technical and advisory services of federal, state, local and private agencies will be utilized to the maximum extent practicable in fulfillment of the responsibilities of the boards.

2155. Implementation of Policy. State and regional water pollution control boards will be guided by the policies hereinbefore stated and by administrative rules and procedures subsequently adopted by the state board for the specific purpose of implementing these policies.

Article 2. Principles and Factors to be Considered in Formulating Waste Discharge Requirements for the Control of Water Pollution

Part 1. Introduction

2160. Statement of Intent. The water pollution control boards are charged with the statutory responsibilities of (1) maintaining highest possible water quality consistent with maximum benefit to the people of the State and (2) regulating the discharge of wastes or waste effluent into the waters of the State without creating adverse and unreasonable effects on the beneficial uses of those waters. Although the prescribing of waste discharge requirements initially is the responsibility of the appropriate regional water pollution control board, the State Water Pollution Control Board may assume this responsibility under the authority of Water Code Section 13025 in the event that the regional board failed to take or obtain appropriate action to correct any particular existing or threatened condition of pollution. In recognition of these responsibilities and for the purpose of encouraging a consistent interpretation of state policy, the state board has set forth, in Part 1 of this article, basic principles to be considered in formulating waste discharge requirements for the control of water pollution.

2161. Maintenance of Water Quality for Beneficial Use. In the formulation of waste discharge requirements, it is recognized that:

(a) Beneficial uses made of a water are the controlling factors in determining water quality levels that are to be maintained.

(b) For every beneficial use, there are certain water quality requirements which must be met to assure that the water will be suitable for that beneficial use.

(c) Receiving waters have varying degrees of waste assimilative capacity, and the addition of waste materials may change the chemical, physical, and biological characteristics of the water without necessarily creating significant adverse effects on the beneficial water uses.

(d) The formulation of waste discharge requirements should be so designed as to (1) secure that degree of care in the planning and operation of works for the treatment and disposal of sewage and industrial wastes as will adequately protect the public health and the beneficial uses of waters of the State and (2) at the same time permit the legitimate planned usage of those waters for receiving suitably prepared wastes so that an orderly growth and expansion of cities and industries may be possible.

2162. Water Quality Objectives. Prerequisite to the prescribing of requirements for specific waste discharges is the enunciation of beneficial water uses which the regional water pollution control board intends to preserve and protect. The enunciation of these uses normally requires (1) a study of the land and water resources of the area of concern, (2) recognition of the policy expressed in Section 2152 of this subchapter, and (3) consideration of both the existing water uses and such probable future uses as may be contemplated by duly-constituted authorities. The board must next define water quality objectives which will assure the suitability of the water for the recognized beneficial uses, giving due regard to the environmental characteristics of the hydrographic unit under consideration. The enunciation of beneficial uses and the definition of water quality objectives can be accomplished by either of the following methods:

(a) Under the statutory authority of Water Code Section 13052 (e), adopting water quality plans and policies for the major hydrographic units within the jurisdiction of the regional board or, until such plans and policies are adopted,

(b) Considering, on a case-by-case basis, the beneficial uses and water quality objectives in the immediate area of the waste discharge.

Where practical and feasible, the state board encourages use of the first method on the grounds that it provides the most sound and rational long-range approach to an effective water pollution control program by making it possible to simplify and integrate the prescribing of waste discharge requirements on major hydrographic units. The second method, however, may be used pending the formulation and adoption of basinwide or regionwide plans and policies under the provisions of Water Code Section 13052 (e).

2163. Area of Waste Dispersion. In formulating requirements for discharges to surface waters, the water pollution control board may delimit a waste dispersion area in the immediate vicinity of a discharge to an extent which, in the board's judgment, will not compromise the beneficial uses and water quality objectives adopted by the board for the general area.

2164. Protection of Ground Waters. The principles and factors expressed in this article shall apply to the formulation of requirements for the discharge of wastes to ground waters as well as to surface waters. However, special account must be taken of the fact that ground waters are of paramount importance in many areas of California and that:

(1) damage to ground waters may be long-lasting and may persist for a considerable time after the source of pollution has been removed; (2) the mechanics of mixing in the ground-water mass is difficult to predict; and (3) under certain conditions, the effect of a pollutant on a ground water may not be readily detected or measured and, consequently, pollution effects may not be manifest for an extended period of time.

Part 2. Evaluation Procedure

2165. Purpose of Procedure. Part 2 of this article outlines a procedure for evaluating waste disposal situations and sets forth the principles and factors on which the State Water Pollution Control Board, as nearly as practicable, will base its decisions in reviewing the actions of a regional board under the provisions of Section 13025 of the Water Code and Subchapter 2 of this chapter. In the interest of uniformity throughout the State, Part 2 also is intended to serve as a suggested procedure for the guidance of the regional boards. The state board shall maintain a file on the procedures used by the various regional boards in evaluating waste disposal situations within their respective regions.

2166. Information Relative to Waste Discharge and Receiving Waters. As the first step in the evaluation procedure, the state board will obtain from the appropriate regional board all available information that is pertinent to the waste discharge under consideration. Where such information is unavailable or incomplete in the files of the regional board, the state board will obtain, from the waste discharger or other sources, information including (but not limited to) the following:

(a) A description of the location of the discharge.

(b) The quantity of the waste (average flows and significant variations).

(c) The pertinent quality characteristics of the waste (average and significant variations) which may affect beneficial water uses.

(d) The existing and probable future water uses of the area of concern.

2167. Dissemination of Information to Interested Agencies. Reports prepared under these procedures by the staff of the state board (after study and appropriate discussion with interested parties) will be transmitted, while in preliminary form and at as early a date as practicable, to the several state agencies having water pollution control responsibilities and to the waste discharger. Also, compilations of pertinent data and information will be so circulated. Said agencies will be solicited for comments and recommendations relative to the enunciated beneficial water uses and the specific requirements necessary to protect fully these uses. Copies of any such comments or recommendations received by the board will be transmitted by the board to the waste discharger.

2168. Determination of Water Quality Objectives and Potential Pollutants. Working from information as provided in Sections 2166 and 2167, the state board will determine the beneficial water uses to be protected and the water quality objectives required to protect fully these uses. In making this determination, the board will take into consideration any water quality plan developed by the regional board under the provisions of Water Code Section 13052 (e). The state board will also determine what constituents in the waste need to be controlled, reduced or removed to assure attainment of the desired water quality objectives. For determining these constituents, the board will consider the existing water quality characteristics of the receiving waters, pertinent hydrological data on these waters and, if ground waters are involved, pertinent geological data.

2169. Formulation of Discharge Requirements. On completion of the steps outlined in Section 2168, the state board will, if necessary, prescribe waste discharge requirements to achieve the desired water quality objectives. These requirements may refer to either the waste effluent or the receiving waters or both. In formulating requirements, the board will take cognizance of the type or degree of waste treatment necessary to meet the requirements.

2170. Petition by Waste Discharger for Revision of Requirements. When requirements formulated under Section 2169 are deemed by the waste discharger to be unreasonable, the discharger may petition the state board, within 30 days after discharge requirements are prescribed under Section 2169, to reconsider the requirements, whereupon the procedure set forth in Section 2171 will be followed.

2171. Procedure for Considering Revision of Requirements. If the state board is petitioned to reconsider its requirements, the discharger shall be required, within 60 days after filing of a petition specified in Section 2170, to submit a report consisting of a detailed study of the cost of constructing and operating facilities representing various levels of waste treatment. In addition, the discharger shall submit a careful evaluation of the effects of these various levels of treatment on the board's water quality objectives. Upon receiving such a report, the board will consider, to the extent possible and feasible, the total effect of the alternate levels of waste treatment on the surrounding community and the people of the State. Based on information submitted by the discharger, but not limited thereto, the board will:

(a) Consider the cost of constructing and operating waste treatment facilities necessary to preserve all beneficial water uses enunciated by the board.

(b) Consider the cost of constructing and operating treatment facilities designed to provide waste treatment of a lesser degree (or degrees, depending on individual circumstances) than that determined under subsection (a) above.

(c) For each of the levels of treatment analyzed under subsection (b) above, assess the degree and extent that the quality of the receiving waters will be degraded below the water quality objectives established by the board.

(d) Estimate the degree and extent that the beneficial water uses would be impaired by maintaining receiving water quality at the level or levels determined under subsection (c) above.

(e) Evaluate the tangible and intangible values of the impaired water uses.

(f) By the exercise of judgment, determine whether a modification in the board's water quality objectives is desirable from the standpoint of providing a maximum benefit to the people of the State. If such a modification is deemed desirable, the board (after making its reasoning and decisions known publicly and after giving interested parties opportunity to be heard) may revise its water quality objectives and prescribe waste discharge requirements based on protection of beneficial uses enunciated in the revised objectives.

APPENDIX B

ATTENDANCE ROSTER

Conference on Pollution of the Interstate Waters
of the Colorado River and its Tributaries

Second Session, May 11, 1961

Joseph B. Anderson	U. S. Public Health Service Dallas, Texas
John T. Barnhill	U. S. Public Health Service Washington, D. C.
H. G. Baty	Uranium Reduction Company Moab, Utah
E. F. Bevens	California Water Pollution Control Board Blythe, California
Robert G. Beverly	Union Carbide Nuclear Company Grand Junction, Colorado
Paul R. Bonderson	California Water Pollution Control Board Sacramento, California
Charles G. Caldwell	New Mexico Department of Public Health Santa Fe, New Mexico
Lewis K. Clark	U. S. Forest Service Ogden, Utah
James B. Coulter	U. S. Public Health Service Washington, D. C.
Jack Crisci	Nevada State Department of Health Las Vegas, Nevada
F. E. DeMartini	U. S. Public Health Service Robert A. Taft Sanitary Engineering Center Cincinnati, Ohio
John G. Detmer	U. S. Department of Health, Education, and Welfare Denver, Colorado

Paul W. Eastman	U. S. Public Health Service San Francisco, California
Garry L. Fisk	U. S. Public Health Service Bureau of Reclamation Salt Lake City, Utah
J. W. Fitzpatrick	U. S. Public Health Service Denver, Colorado
Robert W. Flick	United Press International Las Vegas, Nevada
William N. Gahr	Colorado State Department of Public Health Denver, Colorado
D. R. George	U. S. Atomic Energy Commission Grand Junction, Colorado
Seth Gordon	President's Water Pollution Control Advisory Board Sacramento, California
Dr. Earl Gould	City Health Department Henderson, Nevada
Harry Gutterman	Arizona Legislative Council Phoenix, Arizona
Russell Hart	U. S. Public Health Service San Francisco, California
Croswell Henderson	U. S. Public Health Service Colorado River Basin Water Quality Control Project Laboratory Salt Lake City, Utah
John W. Hernandez	New Mexico Department of Public Health Santa Fe, New Mexico
W. V. Iorns	U. S. Geological Survey Salt Lake City, Utah
Burge Irelan	U. S. Geological Survey Yuma, Arizona
T. F. Izzo	Uranium Reduction Company Moab, Utah

C. B. Jacobson	U. S. Bureau of Reclamation Salt Lake City, Utah
Harry Kagan	Nevada State Department of Health Las Vegas, Nevada
F. W. Kittrell	U. S. Public Health Service Robert A. Taft Sanitary Engineering Center Cincinnati, Ohio
Jules M. Klagge	Arizona Legislative Council Phoenix, Arizona
Frank E. Long	Wyoming Stream Pollution Control Advisory Council President's Water Pollution Control Advisory Board Buffalo, Wyoming
George W. Marx	Arizona State Health Department Phoenix, Arizona
C. C. McDonald	U. S. Geological Survey Yuma, Arizona
Honorable Robert E. Morrow	Arizona State Senator Kingman, Arizona
Kaarlo W. Nasi	U. S. Public Health Service Denver, Colorado
Donald A. Nussbaumer	U. S. Atomic Energy Commission Washington, D. C.
Herbert R. Pahren	U. S. Public Health Service Colorado River Basin Water Quality Control Project Denver, Colorado
Dr. H. E. Pearson	Metropolitan Water District LaVerne, California
Charles H. Petersen	U. S. Public Health Service Colorado River Basin Water Quality Control Project Denver, Colorado

Albert L. Platz	U. S. Public Health Service Division of Indian Health Window Rock, Arizona
Travis H. Redman	Texas Zinc Minerals Corporation Grand Junction, Colorado
Jack W. Rodner	U. S. Bureau of Reclamation Boulder City, Nevada
D. E. Rushing	U. S. Public Health Service Colorado River Basin Water Quality Control Project Laboratory Salt Lake City, Utah
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Carl Schmidt	Arizona Water Company Phoenix, Arizona
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Charles E. Sponagle	U. S. Public Health Service Colorado River Basin Water Quality Control Project Denver, Colorado
Murray Stein	U. S. Public Health Service Washington, D. C.
Jerome H. Svore	U. S. Public Health Service Dallas, Texas
Lynn M. Thatcher	Utah Water Pollution Control Board Salt Lake City, Utah
Dr. E. C. Tsivoglou	U. S. Public Health Service Robert A. Taft Sanitary Engineering Center Cincinnati, Ohio

R. A. Vanderhoof	U. S. Public Health Service Robert A. Taft Sanitary Engineering Center Cincinnati, Ohio
W. W. White	Nevada State Department of Health Reno, Nevada
David B. Willets	California Department of Water Resources Los Angeles, California
Charles T. Wright	U. S. Public Health Service San Francisco, California
A. W. Yoder	Arizona Game and Fish Commission Phoenix, Arizona
Raymond E. Zink	Nevada State Health Department Las Vegas, Nevada

TRANSCRIPT OF CONFERENCE

in the Matter of

POLLUTION OF THE INTERSTATE WATERS OF THE COLORADO RIVER AND ITS TRIBUTARIES, THIRD SESSION

Reconvened in Third Session
on the Call
of the Chairman of the Conference
Under Section 8 of the
Federal Water Pollution Control Act
(33 U.S.C. 466 G et. seq.)

U. S. Department of Health, Education, and Welfare
And the State Water Pollution Control Agencies of
Arizona - California - Colorado - Nevada -
New Mexico - Utah - Wyoming

Salt Lake City, Utah May 9 and 10, 1962

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Conference on Pollution of the Interstate Waters of the Colorado River and its Tributaries, Third Session

Auditorium
New State Office Building
Salt Lake City, Utah
May 9 and 10, 1962

Chairman: Mr. Murray Stein
Chief, Enforcement Branch
Division of Water Supply and Pollution Control
U.S. Department of Health, Education, and Welfare
Washington, D. C.

Conferees: Mr. Kaarlo W. Nasi
Regional Program Director
Division of Water Supply and Pollution Control
Public Health Service, Region VIII
U. S. Department of Health, Education, and Welfare
Denver, Colorado

Mr. George W. Marx
Director, Division of Sanitary Engineering
State Department of Health
Phoenix, Arizona

Mr. Paul R. Bonderson, Executive Director
California State Water Pollution Control Board
Sacramento, California

Mr. William N. Gahr
Director, Division of Sanitation
Colorado State Department of Public Health
Denver, Colorado

Mr. Charles G. Caldwell
Director, Environmental Sanitation Services
New Mexico Department of Public Health
Santa Fe, New Mexico

Mr. Lynn M. Thatcher, Executive Secretary
Utah Water Pollution Control Board
Salt Lake City, Utah

Mr. Arthur E. Williamson
Director, Division of Environmental Sanitation
Wyoming Department of Public Health
Cheyenne, Wyoming

Not Represented: Nevada State Department of Health

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The Conference met, pursuant to notice, at 10:00 A.M., May 9, 1962, in the Auditorium, New State Office Building, Salt Lake City, Utah, Mr. Murray Stein, Chairman, presiding.

MR. STEIN: The Conference is open.

This Conference in the matter of pollution of the interstate waters of the Colorado River and its tributaries, between the States of Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming, and the Department of Health, Education, and Welfare, is being held under the provisions of the Federal Water Pollution Control Act. Under Section 8 of that Act, pollution of interstate waters which endangers the health or welfare of persons in a State other than that in which the discharges originate, is subject to abatement.

We have a rather unique conference procedure under this Federal Act. Under this Act this Conference is between the State representatives and the representatives of the Federal Government. Of course, others are invited to participate, but the conferees are representatives of those seven States and of the Department of Health, Education, and Welfare, representing the Federal Government. For these States the conferees are Mr. George W. Marx of the Arizona State Department of Health; Mr. Paul R. Bonderson, California State Water Pollution Control Board; William N. Gahr, Colorado State Department of Health; Mr. Wallace W. White, of the Nevada State Department of Health, who will not be with us today; and on my left will be Mr. Charles G. Caldwell of the New Mexico Department of Public Health; Mr. Lynn M. Thatcher of the Utah Water Pollution Control Board; and Mr. Arthur E. Williamson of the Wyoming Department of Public Health.

Mr. Kaarlo W. Nasi, the Associate Regional Health Director for Environmental Health for the Public Health Service, with headquarters in Denver, is a conferee for the Public Health Service; and my name is Murray Stein, and I am from headquarters in the Department of Health, Education, and Welfare, in Washington.

The first step in our procedure is the calling of a conference. The purpose of the conference is to bring together representatives of the States concerned, and the Department of Health, Education, and Welfare, to review the situation, to lay a basis for future action by all parties concerned, and to give the States and localities an opportunity to take any indicated remedial action under State and local law.

The conference technique is a very useful one in getting the States and Federal Government together to initiate remedial and corrective action on large segments of a river basin. This Conference on the Colorado River Basin includes one-twelfth of the Continental United States. As you can see by the representation at this table, it is the largest one ever attempted in land area. As a matter of fact, in order to accomplish the field studies done that are necessary to provide the information for the conferees, we have had to establish a special project. This project now employs about forty-one people devoting full time to laboratory and field investigations in the Colorado area; and we have it budgeted at about $450,000 a year--almost a half a million dollars a year. So you can just see the field work alone on that is a very large undertaking.

In addition to that, we regard the conferees representing the States here, and us, a sort of board of directors of the project, and we are happy to see that at the third session of the Conference all determinations have been made unanimously. We have had unanimity of opinion on all actions here, and we hope that this will continue.

By the way, the first session of the Conference was held in Phoenix, Arizona, on January 13, 1960. The second session was held at Las Vegas, Nevada, on May 11, 1961. Of course, this is the third session of the Conference.

I think the conferees at previous sessions have determined that the Colorado River was an interstate water within the meaning of the Federal Act. At the first session of the Conference the Department of Health, Education, and Welfare agreed to undertake, in cooperation with the States, an investigation and study to define the type of interstate pollution problems that might exist in the interstate waters of the Colorado River and its tributaries, and to include, among other things, a determination of the specific pollutants and their concentration, and methods of securing the best water quality for municipal use.

The Public Health Service further agreed to present a detailed plan of study and investigation to the States and Federal agencies for review and comment. At the second session of the Conference this was done. The conferees representing all the States and the Federal Government agreed to the details of this study and investigation, and the study and investigation has been designated as the Colorado River Basin Water Quality Control Project, and will require about six years for completion.

As I mentioned previously, the staff has been organized and we will hear from representatives of that staff as to the work they have done during the last year, and their plans for the next year.

In order to service this project, we soon found there was a need to have a laboratory having particular and pretty specialized skills to do the work. Because of the complex nature of the problem, involving chemicals and radioactive materials, we had to search for a staff and a location. The location of the laboratory, or the best one we could find, was determined to be right here in Salt Lake City at 1750 South Redwood Road. We will have a formal dedication of that laboratory tomorrow. The laboratory is staffed and all of you are welcome to come out to the laboratory to see the type of work that is being done there, and the type of equipment that we have.

Generally speaking, in pollution the important thing is to get an accurate description of what has happened. Once we get a description we will then find that all reasonable men can agree to the description. After all,

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we are defining physical facts, and reasonable men should be able to come to an agreement on what the physical facts are. However, in a complicated situation such as we have on the Colorado River Basin, these physical facts are not always very easy to find and to determine. I think we have made substantial investments in the latest type of electronic equipment, and using the latest methodologies, and we hope that you people will find the time to come out and examine and inspect this laboratory.

The initial studies of the project during the first years had been directed primarily toward the radiological aspects of basin water pollution. This was done on the unanimous recommendation of all the conferees. While there are many, many problems in the basin, it was agreed that we would give the radiological problem the highest priority. On the basis of national work I am proud to say that I think our progress in dealing with this radiological problem in this basin has been the best, bar none, in dealing with any municipal and industrial waste pollution problem anywhere in the country. I think it is fair to say that the results have been nothing short of spectacular. Nowhere in the basin, except for a certain land situation which may come up, is there anywhere that we can say that there is any present or possibly a future danger from uranium mill activities to health and welfare. The objectives and standards which have been put out by the Atomic Energy Commission and other official agencies have been more than met. The radiation level is far below that.

We have had tremendous cooperation from the uranium industry, and cooperation from the Atomic Energy Commission, and cooperation from the States. I think we have a fine group of scientists working on our staff who are indeed to be commended for this achievement. I think this is the kind of demonstration which will benefit the whole Colorado River Basin in its entire stretch, not only for years to come, but for generations to come. I think that the scientists here and the States recognized the problem in its incipiency and moved with dispatch. The Atomic Energy Commission fully cooperated, and industry fully cooperated. I think we have an industry which could grow, and which could take its place in the economy of this area without causing any adverse effects.

In the radiological field there has been considerable reduction in environmental radiological contamination from uranium milling wastes.

At the last session, that is, the second session, it was found that due to the presence of toxic non-radioactive materials from the uranium milling wastes discharged to streams there was damage to the aquatic biota. I might point out this has nothing to do with the radiation problem, but it is an important garden variety of industrial waste, not radioactive materials, that are a residue of any industrial processes and/or extracting processes.

It was especially noted in the Dolores River System in 1960, and also in 1958 in the Animas River; but since then waste control measures installed in the Dolores uranium mill have reduced pollution from this cause with the result that in the 1960 surveys a definite gain in the downstream aquatic biota was noted.

These people here will speak for themselves. I think the trend is continuing in that direction. Here we have a perfect example of what good housekeeping and pollution control practices can do to a stream. I think we may have practically a complete recovery.

Crops at a small number of farms, it was discovered and was reported at the last Conference, in certain defined areas in the upper basin, have been found to contain radioactive contamination above acceptable levels; the radium content of certain dry washes receiving effluent from the uranium mills at Maybell, Colorado, and Mexican Hat, Utah, and South Creek, which receives the effluent from the flows of the uranium mill at Monticello, Utah, were found to be sharply higher than environmental levels. All of this material applies to last year.

It was necessary to develop means of preventing accidental releases of radioactive tailing liquors from uranium mill ponds, such as occurred at Shiprock, New Mexico, in late 1960.

A substantial amount of work has been done in implementing one of these major objectives of the project, namely, the development of a comprehensive plan for long-range water quality management in this area. Such a plan is all-important in a relatively arid area where right now the water is the limiting factor of population and industrial growth. We have to do everything we can, and we must do that in accordance with a long-range comprehensive plan to provide maximum reuse of water. Such work includes the institution of studies of practically all characteristics of water supply, the development of methods to be used for maintenance of satisfactory water quality, the collection of basic data concerning water uses and waste discharges in the basin, pinpointing places of such discharges, and the present and potential economic development of the basin and its dependence on water supply. A detailed analysis of the United States Geological Survey data concerning the chemical quality of water in the basin is underway, utilizing modern data processing methods. Plans are reaching completion for the installation, maintenance and operation of a radioactivity monitoring system for the waters of the entire river basin, comprising 25 to 30 sampling stations to be operated in cooperation with the State agencies to assay the radiological content on a continuous basis.

Field work in connection with the establishment of these stations has begun. We will get a full report on the progress of this monitoring network from the people in the field.

The conferees agreed last year that the following matters would receive the greatest attention during the year which has just passed:

Further general reduction in radioactive pollution of waters of the basin so as to protect the municipal and other water users both inside and outside the basin.

Specific reduction in radioactive contamination of the waters in certain defined areas in the upper basin being used for irrigation which is resulting in contamination of crops in these areas.

Continuing monitoring of the radioactive content of river sediments throughout the basin.

Specific action directed toward the reduction of the toxic effects of uranium mill wastes being discharged in the basin.

Provisions for a safety factor to prevent accidental spills of wastes from uranium mills through the following steps:

(a) Development of criteria for the construction, maintenance, and operation of control facilities;

(b) Determination of compliance with such criteria;

(c) Development and initiation of an adequate alerting system to provide immediate notice to State and Federal agencies of accidental spills.

In addition, a detailed study to discover the causes and extent of quality deterioration in the waters of the Colorado River in the Yuma, Arizona, area, which has required and did require the city last year to abandon the use of a substantial quantity of such water as a source of its public water supply, and an immediate solution of the problem, with full protection being accorded all municipal, agricultural and industrial interests concerned.

Invitations are readily extended by State agencies to all industries in the basin who are interested in water quality, to participate in future sessions of the Conference.

We agree to solicitation from industries of all available data on basin water quality and reports on what actions are being taken by them affecting it. We agreed also to the furnishing to State agencies on a quarterly basis of all available raw and analyzed data on all aspects of the project being accumulated by our Department, so that it can be easily extracted by the States.

The conferees agreed last year that reports would be prepared during this last year and presented to this session of the Conference covering the following:

1. Compliance with criteria developed for construction, maintenance, and operation of the uranium mill waste control facilities on a mill-by-mill basis; system utilized for alerting State and Federal agencies of any spills, and how it is operating.

2. The location and extent of discharges of uranium mill and any other industrial wastes containing toxic non-radioactive chemicals which are damaging to aquatic biota, and status of remedial action.

3. The extent of hazards from radioactive contamination of crops in the upper basin attributable to radioactive contamination of irrigation waters, and status of remedial action.

4. The extent of hazards from radioactive contamination of the dry washes at Maybell, Colorado, and Mexican Hat, Utah, and of South Creek, near Monticello, Utah, and the status of remedial action.

5. Status of solution of the water supply problem at Yuma, Arizona.

6. Proposed methods for evaluating long-range effects of radioactive content of basin deposits.

7. Pollution attributable to recreational boating use of basin lakes.

8. Status of study on effects of pollution on oxygen levels in basin waters.

9. Status of study on nitrate concentrations in underground waters in the Shiprock, New Mexico, area.

10. Progress report on development of long-term water quality management program for the entire basin.

11. Reports from industries participating in the Conference of their activities in improving water quality.

12. The quality of water in Lake Mead, and its suitability for use as domestic water supply.

13. Operational status of radioactivity water monitoring network.

14. And, the dilution requirements in the Animas and San Juan Rivers to protect water quality downstream.

With that large mouthful you can see by giving this task to these people, $450,000 a year for these people is not nearly enough. We will see just how much they have accomplished.

We are all interested in your sitting here. We do our business in a public manner and we want to see what we have done in these areas.

A word about the procedure governing this Conference. Mr. Jack Rund, who is one of the top professional stenographic reporters in the country, is making a record of the Conference. We will make a summary of the Conference available to the States for distribution, and also a verbatim transcript of the Conference will be made available. This can also be procured through your State Water Pollution Control Agencies.

We will call upon all departments and the various States for statements. The conferees will be permitted to ask questions. At the conclusion of these we will have first a discussion and then a summary.

We have gone over the Conference procedure with consultants for the States. During the first day's session we are going to try to develop a factual picture of what is being done, and then we will have a recess until tomorrow. This will give the States and others an opportunity to form little groups, if they wish, to discuss the material presented here today. Then we will reconvene tomorrow morning at nine-thirty and have a discussion of this after you have had the benefit of your private discussions, and come to a determination as to where we are going for next year. Then we will attempt to summarize, and we will adjourn for the dedication.

For the benefit of the record, we would like to have any persons making a statement, other than the conferees, come up to the lectern and identify themselves with both their name and organization for the record, before they speak.

With that we will call on Mr. Nasi for the United States Public Health Service -- Mr. Kaarlo W. Nasi.

MR. BONDERSON: Mr. Chairman, before we proceed with the agenda, you did touch upon the purpose of the Conference here. I wonder if you would care to elaborate a little bit on what the function of this Conference is, and the responsibilities of this Conference as it relates to the State participation in the interstate aspects of the problem?

THE CHAIRMAN: Yes. We regard this as a fully cooperative program -- the State and Federal part of the program. The law so provides that the primary responsibility for abating pollution, including interstate pollution, rests with the States, Our role, of course, is that we have a responsibility, too, that is, where pollution in one State endangers the health and welfare of persons in another State, we are obliged to take action under the Federal law.

The purpose here is to lay a basis for future action by all parties concerned, and to give the States and localities an opportunity to take remedial action which may be indicated under State and local law, since the States do have the primary responsibilities and rights in controlling water pollution. We regard our role here as encouraging and assisting the States in that action. We believe consonant with this that we are looking to the States for cooperation, advice and direction, as to where to proceed with the studies and recommendations. We regard ourselves in a partnership operation with the States in this matter, and we look to the States to give us this advice.

The best way I can describe this, and I have done this before, is, I think, that we regard the conferees as a board of directors group. We will take our direction and advice from the determinations made by this group.

MR. BONDERSON: Maybe I should for my edification put this in a little simpler terms. As it relates to the States' participation here, are the States here simply in an advisory capacity to the Project now being carried on by the Public Health Service? Are we simply an advisory group, or do the wishes of the conference have some influence on the conduct of the program, or are we simply here as window dressing?

THE CHAIRMAN: Certainly not in an advisory capacity, or as window dressing. I think under the law you have a direct responsibility here, and an opportunity to participate with direct responsibility. I think that the general direction of the Project comes from the conferees. This is in the same sense again why I used this analogy of the board of directors theme. Possibly the States may or may not want to do this, but this is the judgment. Generally speaking, when you are dealing with a field operation, with people in the field, the plant manager or the person in charge runs the operation, and the board of directors reviews what has been done and discusses the policy, and does it. As we view this, this is a full partnership relationship on this policy operation with the States.

We also try as much as possible within the limits of what the States want to contribute -- and this we said at the first Conference -- to get as much State aid as it is possible for us to get in the actual field studies.

MR. BONDERSON: Thank you very much, Mr. Chairman.

THE CHAIRMAN: Mr. Nasi.

MR. NASI: Thank you, Mr. Chairman.

Mr. Stein has very effectively given us a very comprehensive review of the progress and the challenge to the Public Health Service and the States in connection with the interstate pollution of the Colorado River and its tributaries. The Federal statement for this Conference will comprise a technical report by the Public Health Service, as Mr. Stein pointed out, on the findings and the studies of the Colorado River Basin Water Quality Control Project.

Secondly, we provide an opportunity for the presentation of official statements by other Federal agencies which have the water resource responsibility in the Colorado Basin.

The Project Report to be presented is outlined in the agenda. Mr. Charles E. Sponagle, who has served as the Director of the Project since its establishment back in 1960, will lead this presentation. He and other discussants will deal primarily with the matters which were given the Project by the Conference as outlined by the Chairman, as specific charges for early action.

As the Project Report will bring out, much progress has been made toward the objectives set by the Conference. However, many of the specific goals have not been attained. We have experienced the usual difficulties in tooling for action and the acquisition of technical and professional staffs, and in the building up of the laboratory.

In this connection I should like to reiterate the invitation that was extended by the Chairman, that all are invited to attend the dedication of the laboratory, which is to be held at two o'clock tomorrow afternoon at 1750 South Redwood Road. The address of the laboratory, and a notation as to the program, are also contained in the agenda. The program for this session, today and tomorrow, also provides, as you will see by the agenda, a period for the presentation of reports by representatives of the uranium milling industry. This important item has been included in response to the suggestion of Mr. Bonderson of California, who, as we have already seen, is a very active participant in the conference. He suggested that the uranium milling industry be invited to report on what they are doing in the disposal of radioactive wastes.

I should note that the invitations to the uranium mills have been extended by their State conferees, and we are looking forward to their reports on this important subject.

Without further ado, I should like to call at this time upon Mr. Charles Sponagle for the presentation of the Public Health Service technical report.

Mr. Chairman, while he is coming up, may I ask a question on a point of order?

Would you like to have the introductions of Federal participants at this time, or at a later time?

THE CHAIRMAN: Why don't you do that now?

MR. NASI: All right. I should like very much, Mr. Chairman, to recognize at this time other Federal persons, officials, who are here representing their agencies, which are agencies having the water resource responsibility in the Colorado River Basin.

I will introduce at this time, in response to the suggestion made, those individuals who have indicated they will not make statements, but whom we will merely recognize. Those who will be making statements for their agencies will be recognized at the time that the statements are being made. First, for the Department of Agriculture, I find that all three of the participants for the Department of Agriculture will make statements, so I will defer their introduction.

I am not quite certain about the Atomic Energy Commission individuals. I did talk with them this morning and I think one or two may make statements, so I will just recognize at this time all three individuals.

Mr. Arthur A. Schoen, Division of Operational Safety of the Atomic Energy Commission in Washington. Mr. Schoen.

Mr. Ernest C. Van Blarcom of the Division of Raw Materials of the Atomic Energy Commission in Washington.

Mr. Donald A. Nussbaumer, Division of Licensing and Regulation, Atomic Energy Commission in Washington.

Also, Mr. D'Arcey George of the Atomic Energy Commission Operations Office in Grand Junction.

From the Department of the Interior we are pleased to have Mr. William T. Davoren, Chairman of the Pacific Southwest Field Committee here in Salt Lake City. Mr. Davoren. Mr. Davoren, as you know, has recently taken on this new position replacing Mr. John Hendrickson, who is also here. Mr. Hendrickson.

We have, or will have, a statement from the Bureau of Land Management, and also the Bureau of Reclamation.

From the Bureau of Mines we have Mr. Kenneth E. Tame, Metallurgist with the Research Bureau here in Salt Lake City. Mr. Tame.

I understand we have two individuals from the Bureau of Sports Fisheries and Wildlife of the Department of the Interior, Mr. Lewis R. Garlick, Chief of the Division of Sport Fisheries, from Albuquerque, New Mexico. Mr. Garlick.

Also, Mr. Robert Scott of the Branch of River Basin Studies in Salt Lake City. Apparently he isn't here.

We have two individuals here as official observers from the United States Geological Survey in the Department of the Interior. I would like to call on Mr. S. K. Jackson, Division Hydrologist, Water Resources Division, in Denver. Mr. Jackson.

Also, Mr. Burdge Irelan, Staff Chemist with the Yuma, Arizona, office of the United States Geological Survey. Mr. Irelan.

Representing the Corps of Engineers from their District Office in Los Angeles we have Mr. Joseph McCoy, Chief of the Special Investigations Unit. Thank you, Mr. McCoy.

I should like also to note that Colonel Chester Cohen of the World Health Organization is also here. Colonel Cohen. It is very nice to have you here.

Also an old friend and colleague, John (Jack) Detmer, Regional Attorney, United States Department of Health, Education, and Welfare, at Denver.

Those are the introductions of Federal personnel outside of the Public Health Service who are here. We will introduce other Federal speakers as they come up. I would like to have the names passed to me of any other Federal participants who wish to be recognized in the event I have overlooked some. Mr. Gahr reminds me that Edward Moulder, District Engineer, United States Geological Survey in Denver, is also here.

Nice to see you, Ed. I'm sorry I overlooked you.

There are a number of Public Health Service scientists and engineers here who are actively engaged in and interested in this particular activity. I advance an apology to them. I won't name them all, but I would like to name a few of the key individuals who had a very specific role in this connection.

First I would like to recognize, as we in the field will always do first, those individuals from the headquarters staff in Washington.

Mr. Stein, whom you have already met, is the Chief of our Enforcement Branch of the Division of Water Supply and Pollution Control.

Next I would like to introduce Mr. Keith S. Krause, Chief of our Technical Services Branch. Mr. Krause.

Next in the Technical Services Branch in Cincinnati we have the Field Operations Section, a very important segment of the Division for us in the field, and we are pleased to have Mr. Frank E. DeMartini, Chief of the Field Operations Section, here today. Mr. DeMartini.

Very importantly, we have in this program a coordinated activity with other regions outside Region VIII, in which we are now located.

I would like to recognize first Mr. Jerome H. Svore, who is Regional Program Director, Water Supply and Pollution Control, for the Division of the Public Health Service in Dallas, Texas, Region VII.

The State of New Mexico is situated in that region.

To our west is Region IX, and we are pleased to have Mr. Paul W. Eastman, Jr., Regional Program Director of Water Supply and Pollution Control, from that region, at San Francisco.

We are also pleased to have Mr. Lester Klashman, Regional Program Director, Water Supply and Pollution Control for the New York Region, here. Mr. Klashman.

I know I have overlooked a number of Public Health Service individuals here, but that is all for the introductions in this part. We will have further introductions throughout the day.

At this time we will go on to Mr. Charles Sponagle for the Public Health Service report. Mr. Sponagle.

THE CHAIRMAN: It would be helpful if everyone who has a written statement could give a copy to the reporter. Do you have a copy?

MR. SPONAGLE: Yes, I do.

THE CHAIRMAN: Would you give it to the reporter, please?

MR. SPONAGLE: It is the only one I have. I will give it to him later, if that is all right.

During this portion of the Conference proceedings there will be a discussion of the work which has been carried out by the Project since the last Conference session, and the principal activities which we plan for the future.

Following my general introductory remarks, subsequent speakers will discuss pertinent specifics of items involved.

During the past year recruitment of the professional staff for the Project has been essentially completed. At Project headquarters, Denver, competencies now exist in the sanitary engineering, geological, and economic fields. The laboratory staff has been secured to carry work forward in the radiological, chemical, biological and bacteriological analysis of samples collected. Construction of permanent laboratory quarters has been completed and, as previously indicated, will be officially dedicated and open for inspection tomorrow afternoon.

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This past year has been a period of intensive field investigative and developmental work. Investigations into the radiological content of river waters, sediments, and certain farm products have proceeded. The chemical, bacteriological and biological conditions of Basin waters has also been investigated in numerous places. Planning for and implementation of activities in connection with the development of a long-range program of water quality management has progressed. This has included evaluation of existing water quality data, collection of technical basic data, development of field investigations concerning river conditions in certain key areas and initiation of economic studies to define the existing economy of the Basin and its probable future development.

The Project has devoted considerable attention to activities which the Conferees last year agreed should be carried forward. We will here give a report on progress during the past year on the following specific items resulting from the 1961 Conference:

1. Provisions for a safety factor to prevent accidental spills of wastes from uranium mills through development of criteria for the construction and maintenance of dikes for holding ponds.

2. Development of an alerting system to immediately notify State and Federal agencies of accidental spills.

3. Continuing monitoring of the radioactive content of river sediments throughout the Basin.

4. Extent of hazards from radioactive contamination of crops on certain farms in the Upper Basin.

5. Extent of hazards from radioactive contamination of South Creek near Monticello, Utah.

6. Status of studies of toxic effects of uranium mill and other industrial wastes containing toxic non-radioactive chemicals which are damaging to aquatic biota.

7. Detailed study to determine causes and extent of quality deterioration in the waters of the Colorado River in the Yuma, Arizona area.

8. Status of studies of effects of pollution on oxygen levels in Basin waters.

9. Operational status of radioactivity water monitoring network.

10. Progress report on development of long-term water quality management program for entire Basin.

There will be technical reports concerning these items, and, therefore, I will conclude my introductory remarks at the present time, and we will go forward with the subsequent presentations.

I would like to call at this time on Mr. Edmund J. Struzeski, Jr., of the Project staff, to discuss the field studies which we have carried out during the past year. Mr. Struzeski.

MR. BONDERSON: Mr. Chairman, before we begin their presentation, as I understand the introductory remarks here, there will be specific comments on seven items that the Conferees agreed on last year. As I noted it down here, there were nine items on which the Conferees agreed that the most attention would be given to during the coming year, and fourteen items on which they would prepare reports during the year and present them at this session.

THE CHAIRMAN: That is correct.

MR. BONDERSON: Right. Is it to be understood then that there is not anything to report on these other items?

THE CHAIRMAN: I would ask Mr. Sponagle that question and I would suggest, if I might, Mr. Sponagle, as this progresses we might direct ourselves to all of these fourteen points. I think there is some overlap on priority items in the fourteen. I think if we have covered those fourteen points we would probably cover most of them, and if we are not going to report on any of those you might want to tell the Conferees why a report is not being prepared in that area, or what is being done.

MR. SPONAGLE: I can do that right now.

THE CHAIRMAN: Let's see how this develops.

MR. SPONAGLE: All right.

THE CHAIRMAN: I think it may be wise to wait until we have gotten the reports, because the evidence may come out, rather than anticipating lapses before we begin.

MR. SPONAGLE: All right, I will go forward then with Mr. Struzeski.

MR. STRUZESKI: Thank you, Charlie.

Mr. Stein and Conferees, as Charlie already said, my name is Ed Struzeski and I am in charge of the Field Investigations Unit located in Denver. I will discuss primarily the activities of this particular unit.

The Field Investigations Unit serves to collect stream quality data needed to locate areas where any enforcement actions are necessary, and to provide water quality information desired for carrying out a comprehensive water quality management plan for the Colorado River Basin. My discussion this morning summarizes the studies undertaken since the last session of the Conference.

One of the first objectives of the Project at the time of its inception was the establishment of a sampling network intended to provide continuous monitoring of the radiological content of the river waters over the entire basin. Of particular importance were those areas in which effluents from uranium milling operations were discharged to receiving streams. Although some reconnaissance planning was carried out over the first year of Project operation, it has been only within the last seven months that detailed attention has been devoted to the establishment of this network.

As of the present time, seventeen radium monitoring network stations are in operation. The locations of these sampling points are as follows:

The Colorado River Mainstem at Silt, DeBeque, and Fruita, Colorado and immediately above and below Moab, Utah;
The Gunnison River above and below Gunnison, Colorado, and near Grand Junction;
Tomichi Creek near Gunnison, Colorado;
The San Miguel River above Naturita, Colorado and immediately above and below Uravan, Colorado;
The Dolores River at Bedrock and Gateway, Colorado;
The Animas River at the Colorado-New Mexico State line;
The San Juan River above and below Mexican Hat, Utah.

It was originally anticipated that water samples would be collected at all radium monitoring stations by automatic sampling devices. However, serious operating and maintenance problems were encountered in automatic collection of samples and, consequently, only six of the seventeen current stations are mechanically equipped. At the other network locations, grab samples are collected once a day, generally six days a week, and then composited. Maintenance and operation of the automatic stations and collection of river water samples at all sampling stations is undertaken by various individuals on location who are under contract to the Project for services performed.

Radium analyses have been completed on only a small portion of the radium monitoring network samples collected to date. The data on hand consists of six composite samples collected from the Animas River immediately above Durango, Colorado, from July 17 to September 9, 1961, demonstrating an average

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dissolved radium content of .06 micromicrocuries dissolved radium per liter of water; five samples collected from the Animas River at the Colorado-New Mexico State line in the period January 19 to February 21, 1961, containing an average of 0.79 micromicrocuries radium per liter of water; eight samples from this same location in the period July 24 to November 6, 1961, exhibiting radium levels all around 0.20 micromicrocuries per liter; and two samples from Bedrock, Colorado, on the Dolores River in October and November of 1961, containing about 1.0 micromicrocuries radium per liter water.

Continuation of the stations presently in operation and some additional expansion of the radium monitoring network program is contemplated in the immediate future. It is also planned to have many of these samples analyzed for chemical content on a routine basis, if possible.

Three Basin-wide sediment collection surveys for determination of radiological content of sediments were conducted by the Project in August 1960, March 1961, and August 1961. Samples were obtained from approximately 70 locations throughout the Basin on each survey. Although the stations were well dispersed, the majority were located below, and in the areas of fairly close proximity to uranium milling operations. Both pool and riffle samples were gathered at many locations to obtain results more indicative of average conditions at any given sample point. The objectives of the sediment studies were to determine:

1. The radioactivity burden of sediments;
2. The distribution of this radioactivity over the Basin;
3. Effects of river hydrology on the behavior of sediment deposition.

In order to account for hydrologic influences as these would affect the pattern of deposition and nature of such deposits, the first study in this series was conducted during a period of low flow and relatively clean river bottoms. The second survey was undertaken during March of 1961 following a period of extended low flow, and the third study of August 1961 was conducted under conditions similar to the first investigation.

Laboratory results of the gross radioactivity and radium contents of sediments collected in the August 1960 survey were reported at the May 1961 Second Conference Session. In addition, radium levels in sediments collected during the March and August 1961 studies have been determined. The more significant findings indicated by the total data presently available on this phase of study will be presented later in this program by Dr. Tsivoglou of the Robert A. Taft Sanitary Engineering Center.

In order to evaluate the extent of hazards from the radiological content of crops, the program involving collection of samples of irrigation waters, soils and crops from selected farms in the vicinity of uranium milling activities was continued. These additional studies were conducted during June, August and September of 1961. The collected specimens are being analyzed for gross radioactivity and radium content.

The results of the first field study of crops and associated samples undertaken in August 1960 were previously reported at the Second Session of the Conference and are contained in Project Publication PR-5, titled "A Preliminary Investigation of Radioactivity in Crops and Soils on Selected Farms."

A large part of the radiological analyses for samples collected in June, August and September of 1961 have not been completed. However, Dr. Tsivoglou, in his presentation, will describe preliminary findings derived from the data presently available.

A two-week field study of water quality conditions of a large part of the Dolores and San Miguel River system was undertaken by the Project on March 12-23, 1962. The major objectives of this field survey were to obtain more detailed information on the radiological content of Dolores and San Miguel River waters and to attempt to differentiate between natural and man-made sources of radioactivity. There are three uranium milling operations within this area and these are located at Uravan, Vancorum and Slick Rock, Colorado. At the time of the survey, the Slick Rock mill was not in operation.

The survey was comprised of two six-day sampling cycles and was conducted during the period of low winter flow preceding heavy runoff from snowmelt. Flows of the San Miguel River at Uravan and of the Dolores River downstream to the mouth of the San Miguel averaged about 90 and 180 cubic feet per second, respectively.

Daily water samples were collected at 27 river and tributary stream locations and of four effluents emanating from the Uravan uranium mill. Each sample was composited on a weekly basis. River sediments were also gathered at selected locations.

Laboratory work has begun on determinations of chemical, radiological, biochemical and bacteriological levels in the various samples collected. An evaluation of the biological regimen found within waters of the Dolores and San Miguel Rivers was also undertaken during the period March 12-23, 1962. Results of these biological studies will be discussed later by Mr. Henderson.

At the last Conference session the conferees agreed that a detailed study should be undertaken to discover the causes and extent of water quality deterioration of the Colorado River in the Yuma, Arizona area because of the use of the river as a source of municipal water supply for the City of Yuma.

The essential elements of the flow pattern involved are as follows: Discharges from the Wellton-Mohawk District enter the Gila River a short distance above its confluence with the Colorado River. This confluence point is a few miles above Yuma's water supply intake. From Yuma the river continues in a southerly direction to the Northerly U. S.-Mexico boundary slightly below which diversions to Mexicali Valley are made at Morelos Dam. Between Yuma and Morelos Dam, additional variable flows enter the river from the Pilot Knob and Yuma (California) wasteways of the All-American Canal system.

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A network of seven sampling stations was established in this vicinity in June 1961 and has continued in operation to the present. This consists of three stations on the mainstem of the Colorado River, one at the mouth of the Gila River, and three on the Wellton-Mohawk return water conveyance system. The sampling network has been operated with the assistance and cooperation of the Arizona State Department of Health in Phoenix, and the U. S. Geological Survey Ground Water Branch Office, the International Boundary and Water Commission Office, and the Bureau of Reclamation's Yuma Projects Office, all in Yuma, Arizona.

Chemical analyses have been completed for samples collected in this area during June 1961-January 1962. During most of this period a sample was collected at each station once a week. On the basis of these analyses, and information obtained from other sources, the following discussion has been developed relative to the most important considerations involved. It should be emphasized that as results of additional analyses become available, some of the specific numbers here reported will no doubt change, but the relative order of magnitude indicated for the various components of flow are felt to be reasonably indicative of continuing river conditions to the present.

1. The mean yearly flow of the Colorado River at Yuma, Arizona, highly regulated since 1935, has considerably decreased over the period of record. This downward trend is particularly evident from water year 1942 to the present. The mean monthly flow of the Colorado River at Yuma from mid-water-year 1959 to the present has remained fairly constant at approximately 1,000 cubic feet per second.

2. The chloride and hardness concentrations in Colorado River water at the Yuma water plant intake started to increase in October-November of 1960. Monthly average concentrations of chlorides and hardness in the raw water at Yuma approximated 130 and 340 mg/l respectively, in the period March 1958 to October 1960. After January of 1961, the concentrations of chlorides and hardness have both averaged about 750 mg/l.

3. The Gila River has contributed from 65 to 85 percent of the monthly average total weight of dissolved solids at the confluence point of the Gila and Colorado Rivers. The flow of the Gila River at its mouth is comprised almost entirely of return flows from the Wellton-Mohawk Irrigation District. Based on monthly averages, the discharge of the Gila River has contained from 3,900 to 5,600 tons per day of total dissolved solids as compared to 900 to 2,200 tons per day in the Colorado River immediately above the Gila River. Monthly average concentrations of total dissolved solids have ranged from 4,200 to 6,100 mg/l in the Gila River discharge as compared to 870 to 1,080 mg/l in the Colorado River immediately upstream.

Chlorides entering the Colorado River from the Gila River from the same period have ranged from 1,200 to 2,300 tons per day as compared to 140 to 310 tons per day for the Colorado River immediately above; respective chloride concentrations were 1,700 to 2,600 mg/l and 120-180 mg/l.

4. Colorado River water at the northerly U. S.-Mexican border contained from 6,100 to 12,000 tons per day of total dissolved solids on a monthly average basis, with the higher weights occurring during the summer, when substantial flows were entering the river from the Pilot Knob and Yuma wasteways. Concentrations of total dissolved solids varied from 1,160 to 2,500 mg/l as a monthly average.

Chlorides at this same river station varied from 2,100 to 2,800 tons per day and 250 to 900 mg/l based on monthly averages.

The principal consideration in undertaking this study was with respect to the City of Yuma's municipal water supply, which was taken from the Colorado River. The chemical quality of this municipal water deteriorated suddenly and sharply in the winter of 1960, showing large increases in both chlorides and hardness to a point beyond generally accepted levels for public drinking water. It was necessary to supplement the city's supply by water from the Yuma Main Canal. Sufficient water could not be obtained from this source to fully meet supply requirements during 1961, however, and use of river water was continued as needed. Following agreement with the Yuma Water Users Association, facilities were installed by the Water Company in April 1962, so that the entire supply of municipal water for the city is being obtained from the Yuma Main Canal.

Our investigations to date indicate that return flows from the Wellton-Mohawk Irrigation District have been the most significant factor involved in the deterioration of chemical water quality in the Colorado River at Yuma, and are contributing a substantial portion of the total chemical content of river waters in the stretch below the confluence of the Gila and Colorado Rivers.

A field study of water quality conditions in the Animas and LaPlata River Sub-Basins and a small part of the San Juan River Basin from Navajo Dam to Shiprock, New Mexico, was conducted during the period of July 17 to September 4, 1961. The objective of this study was to obtain basic water quality data within the study area and to delineate important factors which influence this situation. This survey also served as a pilot study to acquaint Project personnel with this type of investigation and to evaluate field procedures and techniques.

Weekly sample composites for chemical analyses were obtained on alternate weeks at 38 river stations and of 37 irrigation return flows and 11 municipal and industrial discharges. Samples for dissolved oxygen and coliform analyses were obtained twice weekly at these stations. Determinations of five-day BOD were made every second week of daily samples collected of municipal discharges.

Composite samples were collected for radiological analyses from a few representative river and tributary stations of the Animas and San Juan Rivers and of effluents from the Durango, Colorado, uranium mill. In addition, a fairly extensive evaluation of the biological life within the study area was carried out.

A three-day study was undertaken on August 28-30 to assess the potential organic waste assimilative capacity of a 24-mile reach of the Animas River below Durango. Average median five-day BOD results ranged from 0.58 mg/l immediately above the Durango sewage treatment plant to 2.18 mg/l, 9 miles downstream. Dissolved oxygen results indicated that supersaturation conditions existed throughout most of the sampling period. Since the minimal BOD load in the river produced no recognizable oxygen deficit, traditional oxygen sag techniques for evaluating reaeration capacity were not feasible. Therefore, measurements were taken of the river cross-section every mile and of flow velocities every two miles. The results of this work were then analyzed mathematically and a calculated value for the reaeration constant was obtained. The deoxygenation constant was derived from results of long-term BOD laboratory studies.

Results of chemical analyses showed an increase in average total dissolved solids from approximately 41,000 lbs./day (172 mg/l) near the headwaters of the Animas River to approximately 770,000 lbs./day (362 mg/l) immediately above Durango and 840,000 lbs./day (469 mg/l) near the mouth of the Animas River.

During the period of survey, the average dissolved radium concentration in the Animas River immediately above Durango was 0.05 micromicrocuries and the average content approximately two miles below Durango ranged from .24 to .75 micromicrocuries radium per liter of water. The samples obtained from the San Juan River and analyzed for radioactivity exhibited average radium levels of 0.08 micromicrocuries radium per liter immediately above Farmington, New Mexico, and .11 micromicrocuries per liter in the vicinity of Shiprock, New Mexico.

A geologist was added to the Project staff in January of 1962. Since coming with the Project, he has initiated studies as to the importance of ground water in the Basin. Reconnaissance field trips have been made in areas of Colorado, New Mexico, and Utah, to obtain preliminary observation of the effects of ground water on the surface waters of the river systems.

Preliminary evaluation of waste disposal practices at the Durango, Colorado-Shiprock, New Mexico and Mexican Hat, Utah, uranium mills as to the possible pollution of underlying ground waters by seepage of liquors from storage ponds has been undertaken. This particular study will continue and additionally consider other uranium mills in the Basin.

Areas of geological study to be considered in the future include:

1. The effect of ground water inflow to the Colorado River Basin as this aids in establishing the base flow of the river;

2. Ground water contributions as these affect the quality of surface waters.

Comprehensive field investigation surveys will be conducted over the next thirteen months to obtain extensive background water quality data on the most important streams within the Upper Main-Stem and Green River Sub-Basins. Field study of the Upper Main-Stem Sub-Basin will continue throughout 1962, and include the following:

a second survey of water quality conditions in the Colorado River from Grand Junction, Colorado, to Moab, Utah;

determination of conditions within the Gunnison River Basin;

study of the Colorado River from Grand Valley upstream to the headwaters.

During the first half of 1963, major attention will be devoted to the Green River Sub-Basin in securing the necessary background water quality information for comprehensive program development plans.

That concludes my presentation.

THE CHAIRMAN: Thank you, Mr. Struzeski.

THE CHAIRMAN: Are there any questions or comments? Are there any on this side?

I don't know whether this is the time for this, but are you the man covering the Yuma situation, or will that come up again?

MR. STRUZESKI: No. That was it.

THE CHAIRMAN: That was the coverage?

MR. STRUZESKI: Yes, sir.

THE CHAIRMAN: As I understand it, Yuma has, or has gotten another source of water supply to help them in the situation there. Is this correct?

MR. STRUZESKI: That is correct.

MR. MARX: I should like to mention, and it was not mentioned, that in these studies in the Lower Colorado River Basin the Arizona State Health Department participated in the studies also.

THE CHAIRMAN: Very good, Mr. Marx. The record will show that.

The problem is -- and I might try to put it in a layman's language -- they had a water intake above the city where they were getting their drinking water, and that place became polluted because of the flow pattern. That is the substance of your statement. As you put it in your statement, it was due to the discharge from the Wellton-Mohawk District. Is that correct?

MR. STRUZESKI: That is correct.

THE CHAIRMAN: And Yuma had to go somewhere else to get some additional water to mix it.

MR. MARX: Mr. Chairman, I wonder if I could call on Mr. Richard E. Polenske, of the Arizona Water Company, at this time, to present a statement on that situation in Yuma? That is the utility that furnishes Yuma with this water.

THE CHAIRMAN: Yes.

MR. MARX: Mr. Polenske, would you care to comment?

THE CHAIRMAN: Don't leave, Mr. Struzeski. There may be some questions.

MR. POLENSKE: My name is Richard E. Polenske, and while you can call it an official capacity representing the citizens of Yuma, our utility does serve domestic water to the city, and they are definitely involved in and interested in this particular problem.

The test results which were just recently testified to by this gentleman have been followed very closely, and the statements made are exactly correct, with one exception. That is, that during the fall and summer season of 1961, we were able to dilute the Colorado River water by using water from the Yuma Valley Water Users Association's Canal System, which still resulted in something less than desirable finished water. Subsequently, with the necessary approval of the Bureau of Reclamation, we were able to negotiate a temporary -- and I want to emphasize the word "temporary" -- contract to take all of our water requirements out of the Yuma Valley Water Users Association's Canal. This temporary contract is only for a period of two years, with the possibility of an extension for an additional two years.

This is predicated upon some satisfactory solution being arrived at during the first, initial two-year period.

THE CHAIRMAN: I think, if I may interrupt, for the sake of the record and the audience and the group here, could we not indicate what the situation is? I think some of us are familiar with the situation as it was. Yuma had a water supply intake which most cities have a little above the city. Isn't this correct?

MR. POLENSKE: The intake was on the Colorado.

THE CHAIRMAN: On the Colorado River.

MR. POLENSKE: On the bank. Right.

THE CHAIRMAN: Because of the irrigation return flow and the effect of that on the Colorado River, that water supply intake was not satisfactory. Is that correct?

MR. POLENSKE: That is correct.

THE CHAIRMAN: And you had to go somewhere else?

MR. POLENSKE: That is right.

THE CHAIRMAN: And in order to go somewhere else, it costs more money.

MR. POLENSKE: To the tune of some 30-odd-thousand dollars a year.

THE CHAIRMAN: All right. How much does that add to your water costs in percentage terms? How much does it raise the cost?

MR. POLENSKE: The present contract we are operating under with the Bureau of Reclamation out of the Colorado River is a contract which grants us 50,000 acre feet per year for which there is no charge at present. This was established by prior rights. This present water now we are paying $3.10 an acre foot for. So our situation represents a 100 percent increase in operating costs, from nothing to $3.10 per acre foot.

THE CHAIRMAN: How much does this add to the water bill of the people?

MR. POLENSKE: The annual costs are roughly $32,000 a year.

THE CHAIRMAN: What did it cost before?

MR. POLENSKE: The cost as far as the finished water is concerned?

THE CHAIRMAN: Yes.

MR. POLENSKE: Production costs will increase by what the actual net cost of the water will be from this new source of supply, which is something in excess of $30,000 a year.

THE CHAIRMAN: And this will be passed on to the people of Yuma to pay?

MR. POLENSKE: Very definitely, and they are all very unhappy about that.

THE CHAIRMAN: Do you think it is a satisfactory way to solve a water problem?

MR. POLENSKE: Well, the water problem in our point of view, at least from the Water Company's standpoint, is not solved by this temporary agreement by any means. We are endeavoring to work with the Bureau of Reclamation now, and I am sure the facilities and the backing of this organization and study group here could very well be utilized in it. Our position, frankly, is that the pollution of the Colorado River, as testified by Federal agencies here, is primarily caused--and the graphs will prove it--immediately upon the commencement of the return flow from the Wellton-Mohawk drainage project and the chlorides in particular increased practically overnight to 700 to 800 parts per milligram.

Our position, frankly, as far as being a private utility is concerned is that a Federal agency, by virtue of putting a lot more irrigation projects closer to the area, caused the problem, and we feel it is up to them to solve the problem. That is our attitude.

However, we are endeavoring to solve the problem by getting adequate water whenever and wherever we can get it to solve the problem.

THE CHAIRMAN: One of the tasks that the Conferees gave to the group last year was to try to see if a solution could be worked out for the Yuma project. As far as your statement goes, there has been a temporary solution worked out with an added cost to the people of Yuma of some $30,000, but you do not believe that this is a permanent solution, and the problem is still with us. Is that correct?

MR. POLENSKE: I know it is not a permanent solution because the Yuma Valley Water Users Association will not allow us to use the canal indefinitely, but limited it to two years. It was in effect, "You solve your problem in two years, or get out." And for the record, I can't blame them too much in taking that attitude.

THE CHAIRMAN: Are there any further comments or questions on that?

MR. NASI: Mr. Rodner asks to be recognized. Mr. Rodner is the Regional Supervisor of Irrigation for the Bureau of Reclamation.

MR. RODNER: I do not believe I can let all of these statements go completely unrecognized, because we are disregarding some substantial facts of the contracts with the Arizona Water Company and the City of Yuma. These contracts, as I explained last year at Las Vegas, carefully stipulated that the quality of water was not a consideration. The Yuma people have been aware for years in the location that if the Arizona Water Company chose to take the water for the City of Yuma, it was going to receive additional salts. It has been known for a long time it is the only drainage outlet we have for the Wellton-Mohawk project, and also for the South Gila project.

The City of Yuma, as well as the Arizona Water Company, have had ample opportunity to get desilted water from several points on the canals, and could have gotten it from the pump lift where they would not have had to lift the water at all, but we would have done the lifting, and they would have had desilted water.

What you are objecting to is the difference between getting water for nothing, which is rather reasonable in this day and age for a municipality, and paying a few dollars for it. If you look at the history of the cost of water all over the west, I think $3.50, or whatever figure was quoted here, is still a very reasonable figure for desilted water, which is not desilted at their point of diversion.

As far as the water available from the Yuma Valley is concerned, I am quite well aware of the board's attitude. I do not think it is the attitude that you have to get your solution to this in two years or get out. I think that is a pretty strong statement and can't be supported. They are getting a water supply now that is as good as the river can possibly give them. Their contract calls for water at or near Imperial Dam. The fact that they chose to take it at some other point is a matter for their own consideration, and not the Bureau of Reclamation.

I will further state I do not feel it is the responsibility of the Federal Government to correct this condition.

THE CHAIRMAN: Mr. Rodner, do you say from your point of view that there could be a permanent solution, a satisfactory solution, to the Yuma water supply problem?

MR. RODNER: I think there is no question about it. All they have to do is to take a good, strong look at this contract and get the water from the place they are supposed to get it from in the first place. Of course, they have to pay for it. You have to build a pipeline or something to take water, but when you consider the Los Angeles aqueduct and some other water supplies, why, you realize customarily people have paid to get municipal water, and I think that will be the situation down through the years.

THE CHAIRMAN: Thank you very much.

As you can see, I do not think we have a problem yet that is very easy of solution. It is something that the conferees may want to determine tomorrow. Without attempting to make any statement on it, I want to mention one of the key areas in the problem which I think we have to face, as we are going to have to face this more and more. It is a question as to whether there is any possible validity in a provision in a contract saying that someone downstream won't complain about the quality of water. I know we have a situation here where you are dealing with the United States Government in assigning this contract. As a matter of fact, the Bureau speaks for itself on that. We are one government, and this is the way it operates. However, the question is raised, what would happen if a private corporation had someone sign a contract with them like that? Would that contract or provision of the contract be enforceable? This is not a very simple or easy question to answer. It points up one of our problems that we are going to have to meet in this Yuma situation. I hope we will have some discussion of it and get some direction as to whether we do that.

I agree with Mr. Rodner that it is not for the Government to solve any city's municipal water supply problem. However, we do have an obligation under our Act to look into and try to prevent any kind of pollution which endangers the public water supply. Within this framework I think we have to approach the problem.

Are there any further questions or comments in this regard?

MR. GAHR: I merely want to make a comment and ask some questions of Mr. Struzeski.

It seems to me, as I recall it, basically the purpose of this study was to collect and determine any facts by all the scientific means known. It seems to me we are getting a little bit far afield when we get into things as far as we have in some of these cases in considering abatement, because actually there is a process for that, and I do not believe this has been formalized in the way of complaints through formal channels.

I don't think we should get into that until tomorrow.

I would like to ask Mr. Struzeski a question. In the booklet I have here I am unable to find some of this data you have mentioned. Is it supposed to be in here, or am I unable to find it? There are several statements made, or the remark is made, "No data available."

MR. STRUZESKI: The book you have contains the data passed out yesterday. The data I presented today is included therein in your book, and maybe in a slightly different form. It is actually more complete than the particular material you have before you.

MR. GAHR: It is under the heading "Radium Monitoring Network, Colorado River Project, April 1962."

MR. STRUZESKI: This is considerably further back in that particular publication.

MR. GAHR: I will get with you later and find it. Thank you.

THE CHAIRMAN: Are there any further questions? Mr. Bonderson.

MR. BONDERSON: The presentation that was just given by the Public Health Service involves some pretty fine technical details, and obviously we are not in a position to comment one way or another on them. It is quite apparent you have a very competent technical staff, and they should be able to develop, and I am sure they have developed, a very sound program. However, I kind of wonder about the use of the phrase that "This is what we are going to do." Is this what he means, or is he recommending this program?

THE CHAIRMAN: It is the second.

MR. BONDERSON: It is the second?

THE CHAIRMAN: He is recommending that as a recommendation.

MR. BONDERSON: Thank you.

THE CHAIRMAN: I wonder in this regard if I can to off the record for a second?

(Discussion off the record)

THE CHAIRMAN: Are there any further questions?

MR. WILLIAMSON: How long has the Yuma water intake been in its present location?

MR. POLENSKE: Since 1951, or 1952, as I recall it -- the one we are having reference to here.

MR. WILLIAMSON: Several years prior to the development of the present discharge drainage, or where the drainage comes in?

MR. POLENSKE: The Wellton-Mohawk Project, the project itself, has been under development for some several years, but as far as the drainage canal system, yes, prior to that.

MR. MARX: But Mr. Polenske, while that intake area or location may not be in the exact spot, it has been around there for many, many years.

MR. POLENSKE: Oh, it has been in that general vicinity of, I would say, 1,000 yards from the present intake from the beginning of Yuma, back in 1893. The location has not changed within a matter of maybe a thousand feet or something like that.

I might say -- I don't want to debate this with the gentleman from the Bureau because it is not the place to do it -- but my only reason for putting in testimony today is because of the investigation that this pollution committee made. We only wish to reiterate our present-day position, which is to try to solve our own problems from the standpoint of pollution. We feel that the Wellton drainage comes under the broad category of pollution on the Colorado River. Our only view on this, as far as the cost of water is concerned, is the prior river rights are yet to be adjudicated, and we at the present time have been operating on what we feel are valid rights since 1893.

For that reason we feel at least to the extent of those rights we should be entitled to free use of water. Anything in excess of those prior rights, as filed and yet to be adjudicated, we are more than willing to pay for the water over and above that. But as to prior right and usage, we are entitled to that many cubic feet or acre feet per year, or whichever way you want to classify it. To that extent we are entitled to it free, and the Federal Government did recognize that in the contract.

Unless there are other questions, I have no further statement.

THE CHAIRMAN: Any further questions at this time? Thank you very much.

MR. STRUZESKI: There was a question previously which I did not answer in respect to how far do we carry data along. In carrying what we have presented here today I believe what we have presented is data with a very minimum of interpretation. This is opposed to presenting raw data, which really does not give you too much of a picture.

I did want to answer that before leaving the podium.

THE CHAIRMAN: Are there any further comments or questions? If not, Mr. Sponagle.

Thank you very much, Mr. Struzeski.

MR. SPONAGLE: In addition, or as an adjunct to several of the studies which we have reported, we have conducted investigations into biological conditions in the river. Our project biologist, Mr. Henderson, has performed this work and he will give you the results of his studies.

THE CHAIRMAN: Mr. Henderson, we will break sharply at twelve noon. You can take as long as you want with your statement, but if you have not completed by twelve we will break, and then resume after lunch.

MR. HENDERSON: I will be through.

MR. HENDERSON: Studies during the past year have included investigations of biological conditions in several areas of the Colorado River Basin and a study of the toxicity to fish of some industrial effluents that enter the Colorado River or tributaries.

First I want to make a few comments about the Parker-Yuma studies.

In July 1961, the Biology Unit from the Project joined with a survey team from the Robert A. Taft Sanitary Engineering Center, and representatives of the Arizona Department of Health, in conducting limited field surveys--seven days each--of the Colorado River in the vicinity of Parker, Arizona, and Yuma, Arizona. The Parker survey covered the section of the river from above Parker Dam (Metropolitan Water District intake) to Cibola Lake Landing, approximately 120 miles downstream. The Yuma survey covered the section of the river from Fishers Landing, eight miles above Imperial Dam to the Mexican border.

The major purposes of the surveys were to ascertain dissolved oxygen, bacteriological and biological conditions in the river, to locate potential sources of pollution and to determine if more intensive investigations were needed in any sections of the lower river. A report on these investigations is in the final stages of preparation and should be available soon.

Essentially the findings were as follows:

Parker Area:

The area from Parker Dam to Parker (16 miles) is used extensively for recreation which includes camping, boating, boat racing, water skiing, swimming, and fishing, with camps and boat docks lining the river on both the California and Arizona sides. Downriver, there are scattered camps and docks, mostly on the California side all the way to Imperial Reservoir. Major uses also include the domestic water supply for Los Angeles taken off in an aqueduct at the Metropolitan Water District intake above Parker Dam, and irrigation waters diverted to the Colorado River Indian Reservation in Arizona and the Palo Verde Irrigation District in California.

These are just a few of the results.

Bacteriological:

M. F. coliforms ranged from less than 30 per 100 milliliters above Parker Dam to a high of 800 per 100 milliliters in the vicinity of Parker, Arizona. Irrigation returns were slightly higher, ranging from 700 to 1,300 coliforms per 100 milliliters.

These values are not appreciably high. The recreational development has not created any serious difficulty in this area.

Chemical:

Dissolved oxygen conditions were satisfactory with values near saturation at prevailing temperatures (24-30°C). Several irrigation drains were slightly lower. Irrigation drains which ranged from 2,300-2,600 μ mhos/cm specific conductance had little effect on the river, which ranged from 950-1,100 μ mhos/cm.

Biological:

Riffle samples contained a few mayfly nymphs, large numbers of one species of caddisfly larvae (Potamyia sp.), and large numbers of asiatic clams (Corbicula fluminea), especially in the rocky bottom areas between Parker Dam and Parker. Pool samples contained mostly midges and oligochaetes. There were no detrimental effects on and little change in bottom fauna throughout this section of the river.

Potential pollution problems are: possible bacteriological contamination from camping and recreational activities, and chemical contamination from motor boat exhausts and irrigation return waters (new land is being developed in both irrigation projects). None of these potential problems appear to be currently serious.

Now, the Yuma area, which has been pretty well discussed already.

Major water uses in this area include water for irrigation which is diverted at Imperial Dam into the All-American and Gila Canal systems, and the domestic water supply for Yuma. Imperial Reservoir is used fairly extensively for recreation including boating, swimming and reportedly excellent bass fishing. Below Imperial Dam the greatly increased amount of silt discourages recreational usage. There are few, if any, boats and only occasional swimmers and fishermen between Imperial and Morelos Dams. The waters in the Mexican canals below Morelos Dam, in addition to irrigation, are used extensively for many purposes, including drinking, washing clothes, swimming, and fishing. The lower portion of the Alamo canal is used as a domestic supply by Mexicali.

Bacteriological:

M. F. coliform counts ranged from 150 to 450 per 100 milliliters above Yuma to 17,000 at Morelos Dam, four miles below the Yuma sewage outfall, a direct result of raw sewage from the City of Yuma.

Chemical:

Dissolved oxygen conditions were not greatly affected by Yuma sewage and were near saturation values from Imperial to Morelos Dams.

Of course, specific conductance increased greatly upon the entrance of the Gila River--mostly irrigation return waters.

Biological:

In the few riffle areas that could be located, fair numbers of desirable type organisms such as mayfly and caddisfly larvae were present. Pool samples contained large numbers of midges and oligochaetes. A number of asiatic clams were found in all samples. No great change in bottom fauna was found from below Imperial Dam to Morelos Dam.

High water temperatures--33-36°C--and the large amount of silt appear to discourage game fish, but large numbers of carp and mullet were observed. Existing pollution problems include salt from irrigation returns, Yuma sewage, and silt from the All-American desilting basin. Potential pollution problems may include an increase in plankton organisms (counts increased from 500 to 2,500 organisms per milliliter between Imperial Dam and Yuma) from increased nutrients in irrigation return waters and from possible pesticide contamination. No evidence of current pesticide contamination is indicated as live fish and other aquatic animals were found at all stations in all areas of the river.

Another possible problem which cannot be classified as pollution, may be infestations in water lines and irrigation structures by the asiatic clam, which was introduced and which is becoming very abundant in the lower Colorado River.

Bioassays:

Bioassays were conducted on thirteen effluents, from seven operating uranium mills in the Colorado Basin and one effluent from the Gilsonite Oil Refinery below Grand Junction. Effluents were collected from the mills in March 1962 and the effluents were brought to the Salt Lake City laboratory for bioassay. Fingerling rainbow trout were the test fish and conditioned Salt Lake City tap water was used for dilution. The Salt Lake City water was somewhat lower in some characteristics (alkalinity, hardness and conductivity) but would be expected to give reasonably comparable toxicity values.

All of the effluents tested had some degree of toxicity. Among the least toxic were effluents from the Durango mill, the Moab mill, the Rifle mill and the Grand Junction mill. TLm (median tolerance limit--the concentration of effluent that produced 50 percent mortality of ten test fish) values were respectively 29, 7.5, 4.1 and 3.7 percent.

Dilution ratios of effluent to needed dilution water can be readily computed from TLm values. Dividing the TLm value into 100 gives the approximate dilution requirement per unit of effluent to produce a 50 percent fish mortality. This value multiplied by an application factor of 10 gives an estimate of the stream flow required for protection of aquatic life. For example, a TLm value of 5/10 of 1 percent would require 200 cubic feet per second of river dilution, per cfs of effluent. Multiplying that by 10, 1 cfs would require 2,000 cfs of river water for dilution to protect aquatic life.

The most toxic of the effluents which flow directly into a stream were those from Uravan Plant 5 (TLm - 0.40%), Mexican Hat (TLm - 0.45%) and the Gilsonite Oil Refinery (TLm - 0.75%). The Uravan yellow cake tails were also highly toxic with a TLm value of 1.3%. Flows in the San Miguel River are definitely not adequate to meet dilution requirements for the protection of aquatic life from the Uravan effluents. A similar situation would be expected in the San Juan at Mexican Hat; however, this stream at present has little value for aquatic life due to extremely heavy natural silt loads and very limited accessibility. The problem may become more serious when Lake Powell, the impoundment above Glen Canyon Dam, provides better access to the area. The Gilsonite effluent presents a borderline situation which could have some, but not likely a major, effect on aquatic life, except under extremely low flow conditions in the Colorado River.

Highly toxic effluents are stored in lagoons at Rifle (TLm - 0.29%), Durango (TLm - 0.45%), Shiprock (TLm - 0.15%) and Mexican Hat (TLm - 0.26%). Failure of the lagoon dikes or release of any of these effluents would have a drastic effect on receiving waters.

BOTTOM ANIMAL STUDIES:

During various periods of the year, one square yard bottom samples were collected on different streams within the Colorado River Basin, most of them at points above and below uranium mills. Samples were collected in comparably shallow, fast water (riffle), rocky areas, with an 18 mesh hand screen. Samples were preserved with formalin and taken to the laboratory for sorting and identification. While all of the samples have not been completely analyzed, the following information can be reported at this time.

Animas River - Durango to Farmington:

Bottom samples were collected in August 1961 at the same stations previously sampled by J. B. Anderson in 1958, 1959, and 1960. An abundance of clean water organisms such as mayfly, stonefly and caddisfly larvae were present at all stations. It may be concluded that further improvement is shown and that this river has apparently returned to normal biological conditions.

Colorado River - Grand Junction Vicinity:

Bottom samples were collected in September 1961, and again in February 1962, in the Colorado River from about twenty miles above Grand Junction to below the Utah border. A fair abundance of clean water organisms were found at all stations. While the data have not been completely analyzed, no serious detrimental conditions are apparent at this time.

Colorado River - Moab, Utah, Vicinity:

Samples were collected in February and March 1962 from the Utah border to about 16 miles below Moab (vicinity of the new potash plant, now under construction.) Bottom animals were abundant from the Utah border downriver to approximately 10 miles above Moab. Here the character of the river changes greatly from a fast water, rocky bottom stream with many riffle areas to one with reduced current velocity, no riffles and a shifting sand bottom. Samples taken in the lower reaches could not be compared directly with upper sections of the river. At the few suitable sampling areas located, limited numbers of clean water organisms were present. There was little difference in biological populations directly above and below Moab.

Colorado River - Rifle, Colorado, Vicinity:

Samples were collected from above Rifle to approximately 30 miles below Rifle, during March 1962. A large variety and abundance of clean water forms were found at all stations in this vicinity. There was apparently a slight decrease in organisms immediately below the uranium mill outfall, before complete mixing with river water.

San Juan River - Shiprock Vicinity:

Bottom animal samples were collected above and below the Shiprock mill during March 1962. There was no apparent difference in samples collected above and below mill seepage. Fairly large numbers of animals, especially caddisfly larvae, were found at both stations.

San Juan River - Mexican Hat Vicinity:

Samples were collected above and below the mill outfall during March 1962. Few organisms were present at either station.

Dolores - San Miguel Rivers:

During March 1962, bottom samples were collected on the San Miguel River from above Naturita to the confluence with the Dolores and in the Dolores River from Slick Rock, Colorado, to its confluence with the Colorado River above Dewey Bridge, Utah.

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A variety and abundance of clean water organisms were found in the San Miguel River above and below Naturita, below the Naturita mill and above Uravan. With the entrance of the Uravan mill effluent, the river changed from clear to a turbid pea-soup green accompanied by a drastic reduction in bottom organisms, a condition which persisted to its confluence with the Dolores about five miles below the mill.

In the Dolores, samples above and below the Slick Rock mill, which is not operating, contained large numbers of organisms, but mostly short life cycle types such as midges and blackfly larvae. A similar situation prevailed at Bedrock, approximately twenty miles downstream. This is probably due to the fact that the Dolores River was extremely low and sometimes dries up.

A large quantity of salt enters the Dolores from natural drainage in Paradox Valley (specific conductance increases from 1,200 to 16,000 μ mhos/cm). Below this and just above the entrance of the San Miguel only a few midges were present in the Dolores.

Below the entrance of the San Miguel all the way to the Colorado River, the Dolores River is practically devoid of bottom organisms. Only a very few large specimens were found which were probably washed in during high water and managed to exist for a while. Apparently, highly toxic conditions are present in the river system. A more intensive biological study is definitely indicated.

THE CHAIRMAN: Thank you, Mr. Henderson. You made the deadline.

I will leave this to the conferees. Do you want the comments or questions now, or do you prefer to wait until after lunch?

After lunch. All right.

There is one point I want to make clear, so no one goes around with a misapprehension here. The toxic wastes we are talking about are not radioactive. Is that correct?

MR. HENDERSON: That is correct. You have chemical toxicity and they are highly toxic. They may be radioactive. I don't know.

THE CHAIRMAN: You don't know, but you have no evidence that they are?

MR. HENDERSON: Chemical toxicity is what I am discussing strictly.

THE CHAIRMAN: This is what I want to make clear. The kinds of waste Mr. Henderson talked about related to the kinds of industrial wastes which he says are toxic or injurious to fish life and aquatic life which may come from any kind of industrial establishment, and not necessarily radioactive.

With that we will stand in recess until one-thirty. We will come back then and hear from Dr. Tsivoglou, who is always interesting.

(Whereupon, at 12:00 noon, the hearing was recessed until 1:30 p.m. of the same day.)

AFTERNOON SESSION

THE CHAIRMAN: May we reconvene?

Mr. Henderson, would you come up to the lectern, please?

Are there any comments or questions on Mr. Henderson's statement?

MR. GAHR: What do you think caused the greatest damage to aquatic life? I know you mentioned something about silt deposition in regions or stretches of rivers.

MR. HENDERSON: Of course, any type of highly toxic sediment would cause complete destruction of all types of aquatic life if it is toxic enough. Now, silt, particularly shifting sand, does not contain any nutrients or organic material for the organisms to feed on, and they can't become firmly established. Every time they start to establish themselves this bed gets up and moves somewhere else. But certain types of organisms and most of the mayflies and caddisflies and others live in great abundance in silt and fairly well established mud or fine sands, mainly organic; but the toxic situation is the one that gives, of course, the complete destruction of all aquatic life.

MR. GAHR: I was thinking in terms of the results of erosion from, oh, certain construction projects, and perhaps road construction, and things of that type.

MR. HENDERSON: Well, the big change that occurs always in bottom life and in the fish population occurs as a result of various types of pollution. Among fish you have sight feeders that feed only through what they can see and catch. You have vacuum cleaner types that go along and suck up mud, sand and debris through the gills, and pick out the organisms. It's quite a unique mechanism. They can live in any type of muddy, or silty, or other types of heavily organic contaminated waters.

Most of your sight feeders are game fish and desirable for the fisherman, or for fishing at least, because they can see the fisherman's lures. So the thing that happens in that sort of situation is that your desirables, the sportfishing types of populations, are diminished and the others, such as catfish and carp, and so forth, come in. While it may not kill them out, it degrades the stream from the recreational as well as from the fisherman's point of view.

MR. THATCHER: You mentioned something about what I think you referred to as Paradox Valley. Did you find any indication, or did you investigate the possibility that any portion of this might have been subject to control?

MR. HENDERSON: No. We didn't go that far on it. A couple of us were batting it around yesterday, just talking about it a little bit, and there are several possibilities that may help in keeping the brine levels down. Apparently that whole valley, or, apparently, a lot of Paradox Valley is underlain by brine solutions. Union Carbide pumps out brine and pipes it down to their uranium mill. There is another small company, I have forgotten the name, which also commercially pumps out some brine. So the possibility may be that these brine levels could be pumped down, and maybe a new stream bed built or the stream diverted around this particular area. Because the salt has to go somewhere, and it is not pumped out, it enters the stream.

THE CHAIRMAN: Mr. Henderson, did you come to any conclusions as to what these toxic materials might be which debilitate the aquatic population?

MR. HENDERSON: No, sir. Of course, we all know in most of the uranium mills at least the organic waste known as raffinate is the highly toxic material released from most plants. It has not been carried any further than that. We do expect in the future, along with our organic contaminant unit at the laboratory, to try to break down some of these effluents and try to check out the individual toxicants, but that will be a research job.

THE CHAIRMAN: No. That was not what I was driving at. I know scientists are always intrigued by breaking down the toxicants and picking them out, but in certain of the mills, in other actions we have had, we have discovered some of these organic raffinates were extremely lethal to fish, and in fact created a biological desert.

I think for the purposes of water pollution control it might be enough if we just identified it that far, if they could be kept out of the stream.

MR. HENDERSON: I can't do that. I can identify the two wastes of Uravan as Plant 5 wastes and yellow cake tails.

THE CHAIRMAN: In other words, the toxicants you are speaking of that have this effect on the biota of the stream in your opinion are a discharge from the uranium mill?

MR. HENDERSON: In my opinion, yes, sir.

THE CHAIRMAN: All right. Are there any further comments or questions?

If not, thank you very much, Mr. Henderson.

MR. SPONAGLE: The next subject which is to be covered concerns a discussion of our radiological findings. Dr. E. C. Tsivoglou of the Sanitary Engineering Center will present the discussion.

THE CHAIRMAN: Dr. Tsivoglou, do you have a statement you might be able to give the reporter?

DR. TSIVOGLOU: I have a part of a statement.

THE CHAIRMAN: Do you have a copy?

DR. TSIVOGLOU: I do not have another copy here.

THE CHAIRMAN: You have just one copy? I'm sorry. That's all right. I know from past experience when you get into these micromicrocuries, it becomes a little difficult for a reporter, and it would be helpful if you had a copy of your statement.

DR. TSIVOGLOU: I will say, I will try to do my best to be slow and to assist him later.

THE CHAIRMAN: All right. You may proceed, Dr. Tsivoglou.

DR. TSIVOGLOU: As you have heard already this morning, we have gathered considerable data regarding the radioactivity of waters, sediments and crops of the Colorado River Basin during the past year. However, before I discuss the significance of these results, I would like to make a few remarks and bring to your attention certain recently released documents on the subject of standards for radiation protection.

These include the reports of the Federal Radiation Council and the newly revised Public Health Service Drinking Water Standards. These documents reflect the most recent attitudes and approaches to radiation protection in the United States, and their recommendations bear directly on the progress of this Conference, I believe. Generally, they have emphasized the desirability of minimizing all exposure to radiation so far as this is feasible, and have at the same time more clearly interpreted this policy.

These radiation protection guidances of the past year, reinforced by our extensive experience regarding the control of uranium mill wastes, indicate that a high level of radiation protection is both desirable and feasible for the waters of the Colorado River Basin. A little later I will indicate with numbers what kind of a level we have experienced in this regard. First, I would like to quote a few paragraphs from these documents I have referred to.

The Federal Radiation Council was formed in late 1959 by Executive Order No. 10831, and is composed of the Secretaries of Health, Education, and Welfare, Labor, Defense, Commerce, and the Chairman of the Atomic Energy Commission. The Secretary of Health, Education, and Welfare is

Chairman of the Council. The Federal Radiation Council has released two reports since its formation, the first one in May of 1960, and the second in September 1961. So that I am clear on what the Council is to do, I will quote from the first report as follows:

> "It is the statutory responsibility of the Council to '*** advise the President with respect to radiation matters, directly or indirectly affecting health, including guidance for all Federal agencies in the formulation of radiation standards, and in the establishment and execution of programs of cooperation with States ***'"

This is what the Federal Radiation Council does. The May 1960 report of the Council gave general guidance on the subject of radiation protection criteria, which was essentially in close agreement with the recommendations of the International Commission on Radiological Protection--what we call the ICRP.

I would like to quote from this first report of the Federal Radiation Council, as follows:

> "There can be no single permissible or acceptable level of exposure without regard to the reason for permitting the exposure. It should be general practice to reduce exposure to radiation, and positive effort should be carried out to fulfill the sense of these recommendations. It is basic that exposure to radiation should result from a real determination of its necessity."

The second report of the Federal Radiation Council gave particular attention to radiation exposure involving Radium-226, Iodine-131, Strontium-90, and Strontium-89. It provides general guidance for these radioisotopes in terms of permissible daily intakes. It introduced in particular the concept of a permissible range of radiation exposure, rather than a single number that might be looked on as universally applicable.

In the case of Radium-226, which is our main item of interest here, there are three ranges with appropriate actions that the Federal Radiation Council suggests.

Range I is the low range, from 0 to 2 micromicrocuries per day of Radium-226 as an intake. These are low levels. These are in the neighborhood of background or natural levels of Radium-226. For that range the Federal Radiation Council advises "periodic confirmatory surveillance as necessary." In essence, as I read this, occasional sampling is needed to confirm that these are the levels.

Range II is from 2 to 20 micromicrocuries per day of Radium-226, and the "graded scale of action" advised by the Federal Radiation Council is "quantitative surveillance and routine control." These things have to be interpreted. Quantitative surveillance can mean a lot of things. I think as we go along we will see that the radium monitoring network we have established now will suit as far as quantitative surveillance goes. I think it will provide adequate data for this purpose. So far as routine control is concerned, I think that this has been in large part established in the uranium milling industry already.

We have said that Range II was from 2 to 20 micromicrocuries per day of Radium-226 and, in regard to these ranges the Federal Radiation Council states, as follows:

> "Routine control of useful applications of radiation and atomic energy should be such that expected average exposures of suitable samples of an exposed population group will not exceed the upper value of Range II."

That is, 20 micromicrocuries per day intake of Radium-226.

Now, let me try to place these figures in perspective and bring us back to the numbers we have been playing with. You may recall that until now we have been guided by an MPC for Radium-226 of, first 4 and, more recently, 3.3 micromicrocuries per liter of water. These are recommendations of the International Commission on Radiological Protection and the National Committee on Radiation Protection, the NCRP, also. These are concentrations, and not daily intake rates, and so they get multiplied by 2.2 liters per day to get an intake.

To make a long story short, we come up with 7.3 micromicrocuries per day, as the International Commission on Radiological Protection recommended standard for Radium-226. In other words, the International Commission on Radiological Protection's recommendation is pretty near the middle of Range II of the Federal Radiation Council, and the two things are in quite good agreement.

The 1962 revision of the Public Health Service Drinking Water Standards also gives general guidance on the subject of Radium-226. In that document a limit of 3 micromicrocuries per liter is established in agreement with the International Commission on Radiological Protection, and attention is called to the guidances of the Federal Radiation Council for further detail and for further judgment. So the number 3 of itself, since we needed a number for the Drinking Water Standards, is there, but not as a universally applicable number.

The Drinking Water Standards Committee also chose to emphasize the importance of minimizing radiation exposure in the following language, and this is a quote:

> "The effects of human radiation exposure are viewed as harmful and any unnecessary exposure to ionizing radiation should be avoided."

There are several points that should be noted. I do not want to belabor this thing, but there are two points you should be aware of. In the first place, all of these documents are of necessity general rather than exact standards. The detailed local circumstances inherent in any specific pollution problem must finally govern the selection of a specific radiation guide, and this is in keeping with the Federal Radiation Council's guidances also. This is why, for instance, the Federal Radiation Council chose to recommend ranges of intake rather than single numbers. It is also the reason why each document emphasizes the desirability of minimizing all radiation exposure insofar as it can be done.

The implication is clear -- radiation exposures substantially higher than the natural background are not desirable, and all reasonable effort should be made to reduce them.

In the words of the National Committee on Radiation Protection -- and again it is a quote:

> "The goal should be no radioactive contamination of air and water and of the body if it can be accomplished with reasonable effort and expense."

We all understand, I think, these days, that we are not likely again to achieve natural background levels of radiation exposure, or environmental radioactivity; and it is also generally understood and accepted that small increases beyond the natural levels are not likely to result in discernible or significant harm to anybody. Hence, the so-called "benefit versus risk" philosophy of the Federal Radiation Council and the International Commission on Radiological Protection, namely, it is well established that you take a little risk to get some benefits.

It is also well to emphasize, and I repeat the words, "reasonable effort." Herculean efforts are not generally required. I think as we go along we will see that we have not had to require Herculean efforts in the case of the uranium milling industry. But in each case responsible judgment as to what is "reasonable effort" must be made -- preferably, as we have done it so far here, jointly by industry and responsible State and Federal agencies.

One other point in regard to these recent documents is pertinent. One of the reasons -- and there are quite a number -- why we cannot come up with a single number that is regarded as a safe limit involves our lack of knowledge as to the presence of mixtures of radioisotopes. The numbers given in all of the standards documents assume the absence of significant amounts of any other radioisotope that may affect the same body organ. A number of Radium-226, for example, assumes the absence of significant amounts of Strontium-90, and vice versa. We have seen, for instance, in the Animas River case, in the past, that the presence of Strontium-90 from

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fallout substantially reduced the quantities of Radium-226 that could be accepted in the environment. That was in 1959. Since that time the International Commission on Radiological Protection and the National Committee on Radiation Protection have released new compendiums of radioisotopes, and recommended limits, or MPC's.

To be numerical for a minute, while in 1959 we had Handbook 52 available, which listed 69 radioisotopes with their MPC's, in 1960, Handbook 69 of the National Committee on Radiation Protection and Report Number 2 of the International Commission on Radiological Protection came out and listed 264 radioisotopes with separate MPC's. This is over a period of six years. The number of radioisotopes one has to look at has multiplied by a factor of about four times during this period.

Again, I do not wish to belabor this, but I might remark also that of the 69 MPC's present in both documents, there are 12 -- 10 to 12 -- of them, which were reduced over this six-year span by factors of 1,000 or more times. In other words, we had an MPC at a certain level, and then it was decided five or six years later that the level had better be reduced by a factor of 1,000 or more times. So that the standard does change pretty rapidly. Perhaps they won't in the future.

As a result of all this, though, the first thing that happened was that in 1960 we were asked the question and began to wonder whether we didn't have to worry now also about isotopes of thorium, which were suspected to be present in mill effluents, from the study which we did make in the Animas River case.

In this case we were fortunate. Comparison of the MPC's for thorium isotopes with our available data demonstrated that, compared to Radium-226 and Strontium-90, thorium was a negligible hazard, and we were able to "lay this ghost" without extensive field investigation.

However, we have another newly listed radioisotope, Lead-210, which is not quite so readily disposed of. It is a member of the uranium family and, therefore, presumably present in the ores in near-equilibrium amounts with whatever amounts of uranium and radium are present also. Its MPC is quite low. Considering the kidney as the critical organ, and not the bone, its MPC is the same as the MPC for Strontium-90, which I think all of you know is quite potent.

THE CHAIRMAN: Would you quote the figure?

DR. TSIVOGLOU: 33 micromicrocuries per liter is the allowable exposure for the general public. This would be the MPC for Lead-210 in water from the International Commission on Radiological Protection's document. Considering the bone as the critical organ, because we have had to be concerned about the bone in particular, Lead-210's MPC is twice as high as that, or 66 micromicrocuries per liter.

We have had only a handful of liquid and solid samples analyzed for Lead-210. We have had it done by a private laboratory. The private laboratory itself was not satisfied with the results they got so I am not going to present any numbers at all. At this point we know only that Lead-210 does occur in significant concentrations in uranium mill process streams and solids. We do not as yet know how much becomes dissolved in the mill process, nor just how Lead-210 may behave in the water environment, or in crops. These and related questions regarding the importance of Lead-210 as a waste from the uranium mills should be investigated during the coming year, and I imagine they will be.

I don't mean to be doubtful about everything. So, in view of these considerations and recommended practices, namely minimizing radiation exposure, we are very pleased to report that the evidence we have gathered over the past year or two indicates that, with only two exceptions -- and they are not large ones -- the waters of the Colorado River and its tributaries are being maintained at an average dissolved Radium-226 concentration of 1.0 micromicrocurie per liter or less. You recall the International Commission on Radiological Protection's figure is 3.3 for radium in water, but again in the absence of anything else. The level of 1.0 micromicrocurie per liter is from 3 to 10 times the usual naturally occurring, or background, concentration of Radium-226, and it is also well below the current International Commission on Radiological Protection and Drinking Water Standards levels.

To maintain dissolved Radium-226 at an average of 1.0 micromicrocurie per liter or less in the surface waters of the Basin should provide reasonable assurance that the presence of other radioisotopes, such as Lead-210 and Strontium-90, and the intake of all of these materials in food and milk, as well as in water, will not result in total radioactivity intakes beyond the limits recommended by the Federal Radiation Council and the International Commission on Radiological Protection.

Occasional dissolved Radium-226 concentrations slightly higher than the guide of 1.0 micromicrocurie per liter may result from temporary transport of sediments that contain residual spent ore solids; they may result from infrequent and transitory operating problems at a uranium mill, and may even result from mishandling or from inadvertent contamination of samples.

Thus, an occasional result slightly higher than 1.0 micromicrocurie per liter at any location should be expected, and is not cause for concern. It is the average over a period of time that we consider significant at any location, and it is this average that is being maintained now in the waters of the Basin at a level of 1.0 micromicrocurie per liter or less, with the two exceptions I mentioned. I will discuss those in a moment.

It is worthwhile to comment also on how this is being accomplished. This is the high level of radiation protection I spoke about a little earlier. It has been accomplished largely through the control of spent ore solids, and I believe largely through the improved sedimentation practices and tailings pond practices, if you like, that have happened in the uranium mills throughout the Basin. Our sediment surveys bear this out. They do not show the large concentrations of radium in the sediments now that we used to find.

Occasionally a mill has gone to chemical treatment to reduce the dissolved radium concentration in its wastes. This usually, to my knowledge at least, has not happened except in mills that happen to be a fair-sized operation on a very small stream.

I will discuss the two exceptions in a moment, but I believe that if they are cleaned up -- and we have every reason to believe they will be -- and if they approach the level of waste control that the other mills are at, we expect that all of the waters of the Basin will be at the level of 1.0 micromicrocurie per liter or less. I think we have the evidence to show this.

Now for the two exceptions. I will discuss the Monticello situation first. As you recall last year -- and I think Mr. Stein pointed it up -- there were three dry washes or creeks in the vicinity of uranium mills where we found high radium sediment nearby. One of them was Montezuma Creek, near Monticello, Utah. Now in November of last year a survey was done down there by the Project staff in fulfilment of the requirements of the Conferees at that time. That survey covered some 30 miles or so of Montezuma Creek, and at that time radium in sediment as high as 400 micromicrocuries per gram were found. 400 micromicrocuries of Radium-226 per gram of sediment. This is in contrast to our usual background level of about 1.2 or 1.3. And it was as high as had been found in the Animas River earlier, before the cleanup of that river. This is quite a small creek, and we should not over-emphasize this. At the same time, dissolved radium in creek waters ran as high as 27 micromicrocuries per liter. There are a few things to point out.

In the first place, as you will hear later from a representative of the Atomic Energy Commission, this was really a rather poor time for us to do a survey. The tailings pond area -- the old tailings area of the mill which was shut down -- was being worked at that time for dust control and pollution control purposes. Actually, it is quite possible that we did, in sampling right then, get higher results than ordinarily occurred.

Accordingly, the Project staff went back in April of this year, 1962, and surveyed again. The results have been handed to me, yesterday and the day before, which is why there is not any written statement here.

THE CHAIRMAN: Who did that survey? The last one you are talking about?

DR. TSIVOGLOU: The last one was the staff from the Denver office of the Colorado River Project. The samples were handled on a pretty much rush basis by Mr. Rushing's laboratory. The radium in sediment in April, the highest value we found, was 200 micromicrocuries per gram, or only half of what we found before, bearing out that we had done the initial survey in November at perhaps the wrong time, it being not representative of usual conditions. Radium in water, as you will recall, in November had gone up to 27 micromicrocuries per liter. In April the highest value observed was 7 micromicrocuries per liter, again indicating that the results in November were not usual, and indicating also we had at this point an exception to the number that I spoke of before.

We have a small creek, Montezuma Creek, below Monticello, with concentrations of dissolved radium that are higher than we find elsewhere in the Basin. The people from the Atomic Energy Commission have expressed their concern about this. I know they are working on it, and I know they intend to keep working on it. I believe we will hear a statement to this effect later, and we do not regard it as any problem we have to do a great deal more about at this time.

The other exception is in the San Miguel-Dolores River System. You heard this morning somewhat about the presence of toxic, that is, chemically toxic materials in the San Miguel-Dolores River System. We have not completed the analyses of the samples that were collected in March of this year, so that I do not have the radiums to report. The laboratory was pretty rushed the last month or two, and there were just so many samples that could be jammed through.

On the other hand, we have a fair record of the radium concentrations in the San Miguel-Dolores River System below Uravan up to 1961, the most recent study. They range up to 4.9 micromicrocuries per liter; not sharply higher than the level of 3 or 4, but yet quite different than we have observed elsewhere in the Colorado River Basin, and higher than is desirable.

We called attention to this last year at the Las Vegas meeting. At that time we indicated that the radiological pollution of the San Miguel and Dolores Rivers had been compared over a period of two or three years, and we found that the rivers were much better from the radiological viewpoint than they had been, but we indicated also that some further improvement was desirable; and I think the same indication is to be given at this time. We still feel some further improvement is desirable in that case.

Having discussed those two exceptions, I do not want to go into a lot of detail here, but I have just assembled quickly the most recent 100 radium analyses we have of dissolved radium in water. They are mostly results of 1961 sample collections. 85 to 90 percent are below 1.0 micromicrocurie per liter. We have one or two anomalous results that are just above 1.0 micromicrocurie per liter in locations where they should be at background levels. One of them, for instance, is a little creek in Colorado, and I believe there is mining activity above it. We are just going to have to go back to see whether that 1.0 micromicrocurie per liter we found was really natural, or whether there is not some pollution from upstream.

We are interested, among other things, in establishing firmly what a natural radium concentration is, and we are coming rather close to it now. As I said before, 1.0 micromicrocurie per liter will be about 3 to 10 times higher than the natural content.

As for the sediment surveys now. There have been three surveys -- one in August 1960, one in March of 1961, and one in August of 1961. I have a tabulation here of the average results, the average of three samples at each location. One can run a finger down it, and something stands out very clearly. We do have a natural radium concentration in sediment of about 1.3 micromicrocuries per gram of sediment. This will range up to about 2, and in some instances a little higher. So that one can run a finger down this column of figures and pick out any number higher than about 2, and look at it, and it makes a certain sense.

Running down the column of figures, in the first place, we find the San Miguel River, 1.2 miles below the Naturita mill, has a value of 3.6. In that case there are old tailings that have been lying there for years, and they are not as thoroughly confined as they could be. We have always found in that location that the radiums run a little bit higher than natural, even though there is no direct effluent.

The San Miguel River, below Uravan, has an average value of about 10 micromicrocuries per gram -- about 5 or 6 times the natural levels. This is again, let me emphasize, much less than it used to be a few years ago. It is sharply less. On the other hand, it still stands out with accurate measurement as a separate case.

The Colorado River about 1.6 miles below the confluence with the Dolores, shows a value of about 3.5 micromicrocuries per liter, which again is only about twice the background. Yet it is there, and you run your finger down the column and you see it that way.

There are a few values here for Lay Creek on the Yampa River that are up to 8 and 5, but Lay Creek is pretty much dry, and it is not considered a tributary stream. It is a dry wash.

Running down the column of figures, these are the only ones we have to indicate anything different than complete natural data. On the Animas River we have a value of about 2.9 instead of 2. We do not regard this as anything to fret about, and we are tremendously pleased with the quality of the Animas River these days, as you heard this morning.

Running down the column again, we have a few higher values in Lake Mead, which I discussed last year, and I need not go into it now. Then we have data from below the Monticello mill. So you can see that except for the locations I have mentioned, we have natural levels of Radium-226 throughout the Basin, or values approaching that very closely, and so closely we cannot distinguish any further detail.

This indicates again that the sediment survey provides a very sensitive index of what is going on in the Basin, and while perhaps it could be reduced in scope in the coming year, I think it should be continued on a limited basis for quite a while.

There are one or two more items here. We were also to report on a crop survey, I believe. We cannot give you a complete report, again because we were not able to complete the analytical work in the laboratory. We have done quite a few samples, and I won't try to count them up here. We find one or two things of interest in them. I think Mr. Struzeski remarked this morning we had been able to do some of the crops, but we had collected milk and cattle bones, in particular, and had not been able to run these yet in the laboratory.

If you remember, last year we remarked in particular on the high radiums we found in certain alfalfa and pasture grass samples. We followed this up and had the same picture again this year, only with more samples and higher values. We have a pasture grass -- and this is the worst of the results -- we have a pasture grass that contained 1,130 micromicrograms of radium per kilogram of live material. This is quite a high value. There is no escaping it. We have other values that range from 5 to 6 hundred down, and we have some values also that are at essentially natural levels.

We have also analyzed samples of irrigation water which was in use and of the top soil in the fields. One rather interesting speculation at this time has come out of this. It appears that the radium in the crop is related -- I suppose we should have expected it -- more to the top soil concentration of radium than to the irrigation water. The irrigation water may be low in radium now, but the top soil is high and the alfalfa radium will be high. We have this kind of correlation in the data.

We have one farm in particular, the one I mentioned with the 1,130 micromicrograms of radium per kilogram of pasture grass, with 40 or 41 micromicrocuries of radium per gram of top soil. The 41 may be compared to the natural level we have established of about 1.3, and 41 is the highest top-soil value we have found.

The irrigation water that was in use at that place was not high in radium concentration. It was below the level of one micromicrocurie per liter, that I spoke of before. The 40 micromicrocuries per gram of top soil almost surely has to be something that accumulated there in the past when conditions were somewhat different in terms of irrigation water.

One more note and I think this talk is finished. We were also asked to report to you on the possibility of construction criteria for tailings pond walls and an alerting system. The Project made some progress in this during the year, although the press of other business has been such that this job is not completed. Essentially, the Project staff has searched the literature and consulted with various people to try to develop a beginning or a tentative list of what kind of criteria might be desirable and reasonable for these ponds. It has also tried to establish some tentative ideas as to what kind of an alerting system would be useful and practicable.

In the last two months we have found that the Licensing and Regulation Branch of the Atomic Energy Commission has also been working on the same problem. I believe you will hear about this later from Mr. Nussbaumer. The obvious thing has been for the two agencies to get together and see if we cannot establish a joint list of tentative criteria for submission to the Conferees and to the industry for comment before it becomes established. I believe this is the kind of program that the Atomic Energy Commission has in mind, and I believe it can be worked out jointly this way, and I would suggest we do it this way.

So, if the Conferees agree, perhaps within the next sixty days or so such a tentative list might be ready to send out to them for their review.

That summarizes my comments.

THE CHAIRMAN: Thank you, Dr. Tsivolgou.

Are there any comments or questions?

MR. WILLIAMSON: Speaking of this one micromicrocurie as a water concentration.

DR. TSIVOGLOU: Right.

MR. WILLIAMSON: Do you feel this can be met very definitely with normal pollution control methods which should be applied for removing physical contaminants?

DR. TSIVOGLOU: Yes.

MR. WILLIAMSON: And not giving particular consideration to the radioactive?

DR. TSIVOGLOU: Yes.

MR. WILLIAMSON: This would be a bonus then?

DR. TSIVOGLOU: Yes. I think this is right, and I think it is demonstrated by the data. The only two exceptions to that we have noted and we know the reasons for these exceptions. In essentially 85 to 90 percent of the waters of the Basin this criterion has been met, and it is being met routinely now, largely, as I said, through spent ore solids control.

MR. GAHR: In the use of that criterion --

DR. TSIVOGLOU: Let's not call it criterion. I should not have. Forgive me. I should not have used the word.

MR. GAHR: Suggestion, then. This makes it better?

DR. TSIVOGLOU: That is correct.

MR. GAHR: Are we giving due consideration to the natural occurrences of radioactivity, which I don't believe we have looked into quite thoroughly?

DR. TSIVOGLOU: Yes. I believe so. There are data that disagree with this, but we have a consistent set of data as to the natural concentration of radium, and we have gathered it over a period of about five years. We have further, as I mentioned a few moments ago, an occasional anomalous result of about 1 micromicrocurie per liter. I might also note that I have a summary of about 25 or 30 results as determined by the United States Geological Survey in Denver. Their results at natural locations are entirely consistent and in agreement with what we have found. In essence, if we find a value higher than about 3/10 of a micromicrocurie per liter, we will begin to seek out the reason for it. We know background about that closely now.

MR. GAHR: All right.

MR. GEORGE: I would like to ask a question here.

THE CHAIRMAN: Just a moment. I think the rules are that the Conferees will ask questions. Do you have any questions, Mr. Bonderson?

MR. BONDERSON: Last year there was a brief discussion relative to the amount of radium being discharged in comparison to the total amount being carried in the Colorado system. You stated you might be able to estimate the quantity.

DR. TSIVOGLOU: I should have foreseen this question.

MR. BONDERSON: What is the estimate this year?

DR. TSIVOGLOU: You have caught me in an embarrassing position again, Mr. Bonderson. We have not attempted to estimate in this way. The truth is, we haven't gone at it as perhaps you would like us to. We haven't gone at it in trying to estimate from effluent sampling how much radium is coming into a river. We can do this. It has been much more direct and much more useful to us to go to the river itself and measure what is present. So we have not tried to summarize this kind of situation. Pretty clearly, since you asked the question again, we should try to do so, and if you suggest it we will do so in the coming year.

THE CHAIRMAN: Is it useful? What is your judgment?

DR. TSIVOGLOU: I think it could be useful in the summations. I imagine we will have very little difficulty in getting it. For instance, I am sure that the people in the Atomic Energy Commission can help us to assemble data very quickly on it.

THE CHAIRMAN: As I understand the situation, Dr. Tsivoglou, just to clarify some things, the Monticello mill is no longer in operation. Is that correct?

DR. TSIVOGLOU: That is correct.

THE CHAIRMAN: It is closed?

DR. TSIVOGLOU: That is correct.

THE CHAIRMAN: When it was in operation, it was operated directly by the Atomic Energy Commission?

DR. TSIVOGLOU: No, sir, It was operated for the Atomic Energy Commission, I believe, by the National Lead Company. Is that right? I understand it is.

THE CHAIRMAN: But it is closed up now?

DR. TSIVOGLOU: Yes.

THE CHAIRMAN: How long has it been closed?

DR. TSIVOGLOU: About a year and a half, I believe.

MR. GEORGE: Since the end of 1959.

THE CHAIRMAN: What I am getting at, and maybe the Atomic Energy Commission can answer this later, is this: If this is not an Atomic Energy Commission mill and is run by the National Lead Company, does the Atomic Energy Commission have a responsibility and, if so, what is their responsibility and jurisdiction over the property? Maybe they do have it. Maybe they can get that in their statement.

DR. TSIVOGLOU: I can answer it, but I think it would come better from Mr. Van Blarcom and Mr. Nussbaumer.

THE CHAIRMAN: The other point is, is the Uravan mill a licensee?

DR. TSIVOGLOU: It is a private company and a licensee. I believe that is right.

THE CHAIRMAN: Of the Atomic Energy Commission?

DR. TSIVOGLOU: Of the Atomic Energy Commission.

With regard to the point of Mr. Williamson about normal pollution control measures, I can't predict it and I can't be sure, but I would make a very good guess, for example, that if the toxicity problem at the Uravan mills were cleaned up properly, the radium problem would go along with it.

THE CHAIRMAN: I think both of these are pretty small exceptions, but generally you would say -- and this is generally -- but pretty universally in the Colorado River Basin the uranium industry radium levels have been reduced as far as you can see to about one-third of the recommended Public Health Service Drinking Water Standards.

Would it be your judgment that there is no present danger in the general area to health or welfare?

DR. TSIVOGLOU: Yes, it would be my judgment, with the two minor exceptions.

THE CHAIRMAN: That's right. With those two exceptions.

DR. TSIVOGLOU: And those two exceptions I do not believe are worth much concern.

THE CHAIRMAN: In other words, the statement is valid that as far as a radiation problem in this valley is concerned, we are in a situation now where the operation of the uranium mills does not endanger health or welfare?

DR. TSIVOGLOU: I think it might be fair to point out, and some people here might like me to do so, that the concentration of one micromicrocurie per liter that I spoke of is well below the dissolved radium concentrations in quite a number of public well water supplies in the central United States. So I think this places the Basin in a position where it is considerably better off than some other places I know of.

THE CHAIRMAN: I know you had a lot to do with this reduction program, and you may be embarrassed about my asking you this, and you might think it is a self-serving statement, but you heard my remarks in the opening statement where I said that the progress made by the uranium milling industry in the reduction of pollution, and the progress made in this Basin, was as good as, or better than, any pollution control program that I have ever seen in other parts of the country. I know from your work you are familiar with what they are doing in other parts of the country.

Would you be in general agreement with that statement?

DR. TSIVOGLOU: Yes. I don't regard it as self-serving, because I haven't cleaned up any pollution. The uranium milling industry cleaned it up.

THE CHAIRMAN: That is correct.

DR. TSIVOGLOU: And I believe the statement is correct. Yes, sir.

THE CHAIRMAN: I think this is the key point here. I think it is one thing that the uranium milling industry should be proud of, as well as the Atomic Energy Commission and the States, for the work they have done. You have gotten a new industry in your area. We used to say, and I haven't checked the figures lately, that sixty percent of the uranium milling industry was in the Colorado Basin. This is an industry that has demonstrated it has been able to go along on a regular basis and become part of the community and share the load in protecting the environment and the quality of our water. Would you agree with that?

DR. TSIVOGLOU: That's right.

THE CHAIRMAN: Are there any other questions or statements? If not, thank you very much, Dr. Tsivoglou.

Mr. Sponagle? Pardon me. May we ask one more question? We may have covered this, and I think we will go through it in the check of the list. Have we covered, or are you going to cover that monitoring network of the radiation? How far have we gone on that? It was one of the fourteen points.

DR. TSIVOGLOU: I think Mr. Struzeski covered that.

MR. SPONAGLE: He discussed that this morning.

THE CHAIRMAN: All right.

MR. SPONAGLE: Next is a progress report on development of a long-term water quality management program for the entire Colorado River Basin.

Mr. Herbert R. Pahren of our Project headquarters staff will present this discussion.

THE CHAIRMAN: We do not want to cut anyone off. Do you have a question you wanted to ask, Mr. George?

MR. GEORGE: I was wondering on this one micromicrocurie figure, Ernie, at what point on the stream is this sample taken? Is it at the nearest point of use, or just below the mill or where?

DR. TSIVOGLOU: It has been pretty much at random locations, D'Arcey. This simply represents the experience we have had in the last year or two. It is what we have found.

For instance, we found this a mile and a half below the mill at Durango. We have found it quite close to the mill at Moab, and we found it at other locations further removed from mills. It has been our experience of the past year that about 85 to 90 percent of the waters of the Basin are at a level of one micromicrocurie per liter, or less. I am referring, as I said before, to an average level. We have all realized that an occasional result may be a little higher, but I am talking about the average over a period of time.

Does that answer your question?

MR. GEORGE: Yes. Thank you.

THE CHAIRMAN: Thank you, Dr. Tsivoglou. Mr. Sponagle.

MR. SPONAGLE: Mr. Pahren will present the next Project report.

MR. PAHREN: During the past year, Project personnel have continued with the preliminary work needed to develop a comprehensive water quality management plan for the Colorado River Basin. By the very nature of this phase of the activities there is much background work performed before a product is available.

I will briefly review some of the significant items which were undertaken since the last Conference, and also point out a few items planned for the future.

The inventory of municipal and industrial water uses and waste discharges is essentially completed. These data were obtained from the files of State health departments and also by field trips. Characteristics of significant municipal and industrial discharges, where not yet available, will be determined at the time the routine sampling is carried out in the general area of these discharges. This calendar year filed studies will be conducted in the Upper Main-stem Sub-basin, and next calendar year, the Green River and San Juan Basins will be covered.

Results of the first phase of the computer analysis of published U.S. Geological Survey chemical water quality data in the Basin were received from the Sanitary Engineering Center in April of this year. These results are being evaluated and interpreted at the present time. Several methods of analyses will be used with these data, and for illustration purposes I have summarized a few of the preliminary results on the chart.

THE CHAIRMAN: Do you want that chart to go into the record?

MR. PAHREN: I think it would be a good idea.

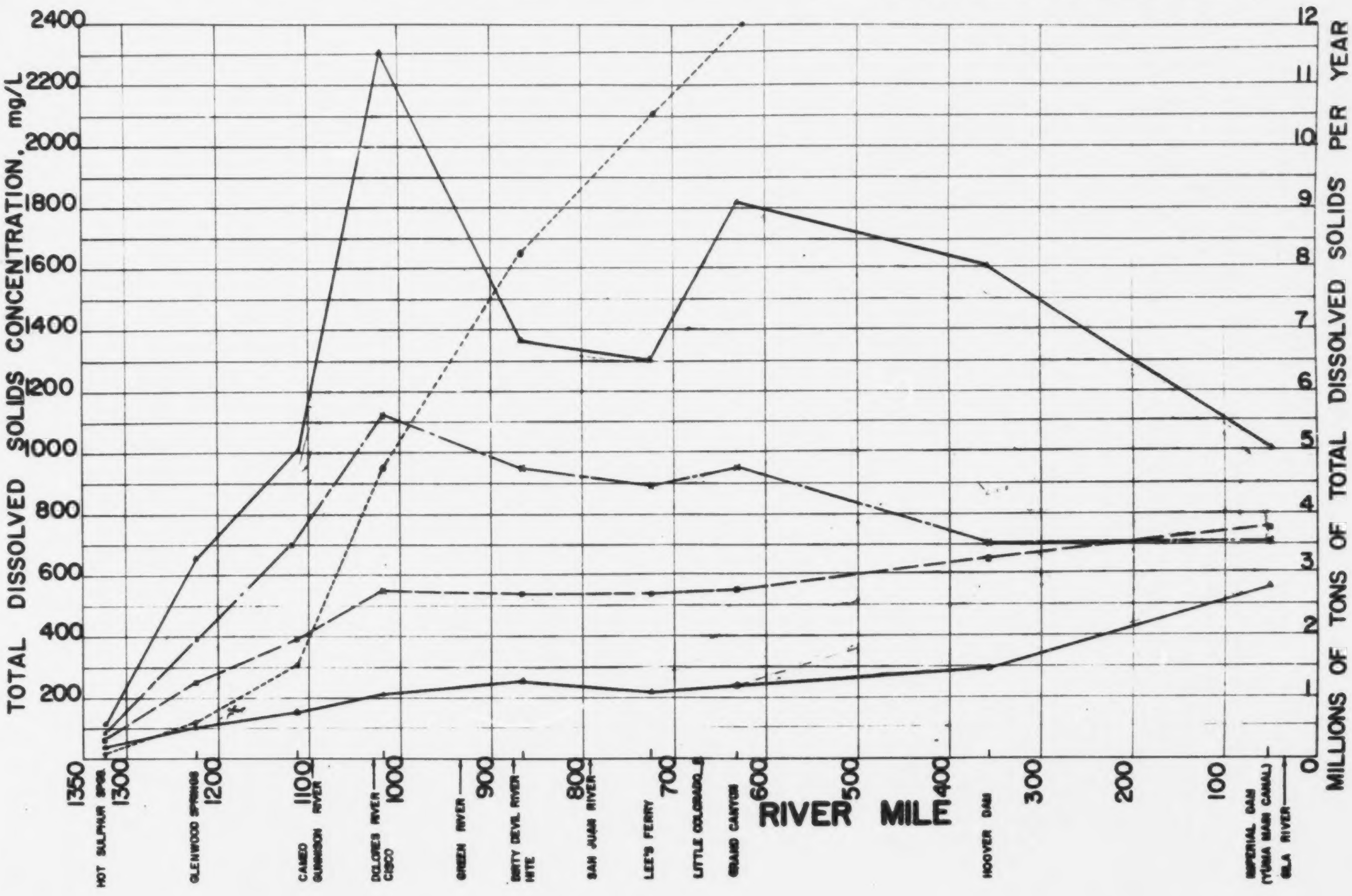
THE CHAIRMAN: All right. As you know, it will appear in black and white and not in color.

MR. PAHREN: Yes, sir.

MR. PAHREN: The first graph I want to speak about shows the total weight of dissolved solids passing a given point along the main-stem of the Colorado River plotted against river miles for the water year 1958. Data in this plotting was taken from data collected during water year 1958. This is the dotted line which starts at this corner and goes up.

Data were used for the free-flowing section of the river from the headwaters to Grand Canyon. There was a very large change between points in the upper section of the river and those downstream. For example, the dissolved solids increased from 600,000 tons just above Glenwood Springs, Colorado, to 12,000,000 tons at Grand Canyon for water year 1958. In a like manner the average concentration of dissolved solids of the water passing downstream showed a large increase, as indicated by the graph. The average concentration, weighted for

COLORADO RIVER MAIN-STEM
WATER QUALITY



flow, above Glenwood Springs, was 262 milligrams per liter. This increased to 553 milligrams per liter just below the confluence of the Dolores River and then was constant down to Grand Canyon.

It might be emphasized that in the unregulated sections of the river, there is a large discharge during the spring and early summer, and a relatively constant low flow during the remainder of the year. Thus, the flow weighted concentrations are much lower than the median concentrations or the value to which the water user would be exposed 50 percent of the time. The median value for total dissolved solids just above Glenwood Springs was 390 milligrams per liter, while the peak median value for the stations was 1130 milligrams per liter and occurred just below the Dolores River. The weighted monthly average of the samples was obtained, and the range of these monthly means is indicated on the chart for the stations on the Colorado River. The lower red line on this chart is the minimum and the upper red line is the maximum monthly mean. It is interesting to note the leveling out effect of Lake Mead. The upper and lower values of 280 to 1600 milligrams per liter occurred prior to the closure of Hoover Dam. Since that time the range has been between 480 and 870 milligrams per liter.

The largest change between sampling stations on the Colorado River occurred between the Cameo station just above Grand Junction and the station just below the Dolores River. A material balance for 1958 in this area indicated that the 2,500,000 tons of dissolved solids were contributed by the Gunnison River, Dolores River, Plateau Creek, and the Grand Junction sewage treatment plant combined and that 650,000 tons of dissolved solids were contributed by other drainages. Of the four discharges mentioned, by far the largest contribution of dissolved solids came from the Gunnison River.

In the near future we will attempt to determine the water quality trends over time and between sampling points in the Basin, and also the causes of poorer quality, from these United States Geological Survey data. After the results of this first phase are analyzed, it is planned to carry out a second phase of the analyses, using different approaches. Significant gaps that may show up in the data will be filled by appropriate field investigations during the routine sampling in the Basin.

Last year I mentioned that a comprehensive program for water quality management must reflect the economic conditions expected to prevail for the period of analysis. An economic base study was therefore initiated. The Project has been collecting demographic and economic trend data which will be used to assist in making projections of future populations and economic development in the Basin. Reports showing a census of manufacturers and tabulations of area by counties and subbasins have been developed. A contract has been signed with the Associated Rocky Mountain Universities to assist us in setting up this economic base study. The Economic Research Service of the U. S.

Department of Agriculture has agreed to develop the agricultural phase of the study, and these results will be tied directly to the overall base study. During the coming year this work will be expanded and economic projections will be carried out in the Green and Upper Main-stem Sub-basins. It is expected that most of this work will be done under contract. However, the staff economists of the Project will coordinate the Department of Agriculture and Associated Rocky Mountain University work, and will provide liaison between these groups with other Federal or State agencies, where necessary, for the collection of data.

During the past year we have been conducting a pilot study in the Animas-LaPlata watersheds in southwestern Colorado and northwestern New Mexico in order to develop our methodology for all phases of our comprehensive planning activities. We hope to learn how our plans can be improved, and to develop short-cut methods of arriving at essential answers for a larger geographical area. This study also is providing experience that will enable us to carry out our activities in the larger areas more expeditiously and efficiently. This work is about half completed at present. With the procedures worked out we expect a savings in time when similar studies are carried out in the remainder of the Basin.

In order to determine whether the water quality in the Basin will be satisfactory for all legitimate water uses, the quality should be compared to quality objectives. These objectives should be based on the quality needed at the point of water use. Therefore, in order to have a basis for comparison, the Project will initiate discussions in the immediate future with the water pollution control agencies of the seven Basin States and with other interested agencies to develop logical water quality objectives.

This concludes my statement, Mr. Chairman.

THE CHAIRMAN: Are there any questions? If not, thank you very much.

MR. BONDERSON: Mr. Chairman, there was a meeting in Denver back in June 1960. At such meeting there was an outline of a tentative plan for the development of water quality evaluation studies for the conduct of the program, and as far as I can recall, we have heard nothing further of it.

THE CHAIRMAN: Would you care to comment on that, Mr. Pahren?

MR. BONDERSON: Has there been any further elaboration on this plan for carrying out this study?

MR. SPONAGLE: I wonder, Mr. Bonderson, if you could indicate a little more specifically what you had in mind?

MR. BONDERSON: In June 1960 there was a meeting in Denver. This was not a formal conference. At such time there was submitted to the group an outline entitled "Tentative Plans for Carrying out Water Quality Evaluation Studies." This pretty well defined the approach that was going to be followed in carrying out this program or project. Has there been any further or more precise definition of what your program is? Has this been accepted as the final plan? What is the status of this?

MR. SPONAGLE: Of the tentative plan?

MR. BONDERSON: Yes.

MR. SPONAGLE: I don't recall the exact details of that, but this has served as a basis for the development of our present approaches to this whole field of water quality planning in the development of the water quality planning program. I believe that all of the items in that outline are included in our present plans, which, of course, have been expanded as we progressed with our work.

MR. BONDERSON: Have we ever been notified of your expanded plans?

MR. SPONAGLE: Only by means of this Conference mechanism.

MR. BONDERSON: Yes. Thank you.

THE CHAIRMAN: Do you want to make any further comment, Mr. Pahren?

MR. PAHREN: The details are outlined in general terms in our monthly report as to the segements that we are covering in our comprehensive management plans in the Basin.

THE CHAIRMAN: Are these monthly reports sent to the States as well as us?

MR. PAHREN: Yes. They are sent to the States.

THE CHAIRMAN: All the seven States represented here?

MR. PAHREN: Yes.

THE CHAIRMAN: Are there any further comments or questions? If not, Mr. Sponagle.

MR. SPONAGLE: As you heard previously, our Project Laboratory will be officially dedicated tomorrow. We have been working on the establishment of this as a permanent laboratory for this Project for some time. I believe it will be of interest at this point to ask Mr. Rushing, our Laboratory Director, to discuss briefly the development of our laboratory and the part it will play in our study.

MR. RUSHING: As indicated at the last Conference, we had expected to get our laboratory started in September. There have been a number of delays caused by slow delivery of equipment to the contractor. However, the remodeling of the laboratory has been essentially completed. About the middle of February, we were able to occupy the space to the extent of unpacking supplies and equipment and getting ready to do laboratory work. The various laboratories are reasonably well equipped to carry out their phases of the laboratory work. By design, the organic chemistry laboratory was the last to be fully equipped. We have received an infrared spectrophotometer and have on order a gas chromatograph and air-conditioning equipment for the organic laboratory. We have a small room set aside for use as an infrared laboratory. This laboratory should be in operation within a few months.

In spite of our remodeling problems, we have been able to participate in the various surveys which were carried out during the past year. By borrowing a large trailer laboratory from the Robert A. Taft Sanitary Engineering Center in Cincinnati, we were able to do chemical and bacteriological work in the field over a period of about six weeks. A temporary laboratory was set up in the building at Salt Lake City so that we could carry out limited chemical analyses and sort biological samples. In the late fall, we acquired a small truck laboratory, formerly fixed up by the Atomic Energy Commission, from General Services Administration. This was converted primarily into a bacteriological laboratory; secondarily, it serves as headquarters for biological field work. Field laboratory work for the Grand Junction and Dolores-San Miguel surveys was carried out in this truck laboratory and in facilities provided through the courtesy of the City of Grand Junction.

Inorganic chemical analyses were performed on 1,941 samples with an average of 4.7 determination per sample.

Radium analyses were carried out by one of our chemists stationed at the Occupational Health Field Station, Public Health Service, Salt Lake City. I should like to express our appreciation to that program for making their space available for an extended time while our permanent quarters were under construction. Approximately 350 radium samples were analyzed during the year by our staff. At the last conference we were asked to investigate further the concentrations of radium in vegetation and foods. Because of the space and equipment limitations at the Occupational Health Field Station, it was not expedient to analyze these types of samples. Our efforts, therefore, were directed toward sediment and water samples, with the hope that the vegetables and foods could be completed in our new laboratory. This aim was achieved only to a limited extent. About 110 radium samples were sent out to a commercial laboratory in order to complete our data on sediment surveys in time for this conference.

We have a considerable backlog of work on hand. This is particularly true of the radiochemical laboratory. So far, we have done nothing but radium and a very few gross alpha counts on waters and sediments. Other radionuclides should be determined on at least some of these samples. We have on hand about 370 water samples, 26 sediments, and 40 vegetable, milk, and bone samples for radiochemical analyses. Some of these water samples are from the radium monitoring network. Inorganic chemical analyses need to be run on some of these samples.

Recruiting of personnel was a major problem during the year. The laboratory staff at the present consists of nineteen persons -- four clerical and administrative personnel, three biologists, one bacteriologist, ten chemists, and one aide.

Equipment either received or ordered during the past year includes:

Biology Laboratory

1. Deionizer for acute toxicity work with fish.
2. Small truck laboratory including special sized equipment for conducting bacteriological work in the field.
3. A boat and boat trailer for sampling.

Inorganic Laboratory

1. Flame photometer used primarily for sodium and potassium analyses.
2. An automatic titrator which can be used for acid-base, redox, or complexing types of titrations.
3. Polarograph - for heavy metal analyses.

Organic Laboratory

1. Infrared spectrophotometer - for organic analyses and identifications. Especially useful when compounds have been separated previously by gas or liquid chromatographic techniques.
2. Dehumidifying air conditioner and furniture for a small infrared laboratory.
3. Gas chromatograph for isolation, determination, and partial identification of organic compounds.

Radiochemistry Laboratory

1. Frisch grid chamber - for identification of alpha emitters by the energy of their alpha particles.
2. Automatic low-level beta counting system.
3. Seven scintillation counters - for radium analysis by the emanation method.
4. An additional scintillation detector and shield - to permit simultaneous gamma counting of two samples with the pulse height analyzer.
5. "Data Stripper" for pulse height analyzer to permit rapid tranfer of data and permanent storage of standard spectra which can be recalled for comparison with unknown spectra.
6. Electrodeposition apparatus - for preparing thin samples and sources in radiochemical work.

Most of this equipment will be on display during the laboratory open-house tomorrow afternoon.

Within the next year, we hope to get set up to carry out chronic toxicity studies with fish. We also hope to delve into areas such as:

1. The extent of pollution by heavy metals.
2. A study of the base exchange properties of soils as they relate to radium. This probably has a definite bearing on the uptake of radium by vegetation.
3. Extend radiochemical examinations to include other radionuclides such as strotium-90, lead-210, and thorium isotopes.
4. Pollution by pesticides and herbicides.

That concludes my statement.

THE CHAIRMAN: Thank you.

Are there any comments or questions? If not, thank you very much.

Mr. Sponagle, do you have anything more?

MR. SPONAGLE: Nothing specific. Just to close our presentation, we have attempted to review the work done this year and the progress that has been made on the items as far as possible, together with our plans for the future.

THE CHAIRMAN: May I suggest for the discussion period tomorrow, Mr. Sponagle, you might wish to go over these fourteen points. I should like you to discuss on your own and find out how many of these you have covered. If there are any which are not covered, I am sure there may very well be questions.

MR. SPONAGLE: We will do that.

THE CHAIRMAN: Thank you.

Mr. Nasi, do you have anything else?

MR. NASI: Mr. Chairman, with your permission I would like to insert in the agenda at this time a very brief statement, which I believe Mr. Sponagle would like to have included, by Mr. David Shearer, who has been conducting graduate studies in the area of radioactivity and uranium mill wastes. I would like to have Dr. Tsivoglou make the introduction in this connection.

Dr. Tsivoglou, would you do so?

DR. TSIVOGLOU: Is Dave here? The introduction need not be long.

Dave was on my staff in Cincinnati for about four years before the Service sent him to school. Essentially he did field work on the Animas

River studies a few years ago, and the Service felt that he was quite a good workman and ought to go to school and maybe learn a little bit more. He has been at Madison, Wisconsin, now for two years, at the University of Wisconsin, and I think he has distinguished himself, among other things, by his hard work while he was there.

I think he has done some very interesting doctoral research on the leachability of radium.

Mr. Shearer.

MR. SHEARER: Thank you, Mr. Nasi and Dr. Tsivoglou. I have a cold so I hope you will bear with me in the brief presentation that I have.

As you know, previous work, particularly on the Animas River, pointed out very clearly that significant concentrations and amounts of radium can be leached from water with uranium mill waste solids, as well as radium contaminated river sediments.

In this connection Mr. Rushing in 1958 carried out a brief set of laboratory studies to show that this could be done, and that radium could be leached from these materials, and confirmed that this could happen. Because there was no published information in the literature concerning the leaching of radium from natural sediments or from waste solids, it was felt necessary to undertake such a study.

Therefore, in the summer of 1961, representative samples of waste ore solids from uranium mills in the Colorado River Basin, and from river sediments within the Basin, were collected. These were transported to the laboratory and various studies were undertaken. The general approach which was taken was to subject these various solids materials to leaching with various volumes of different kinds of leaching liquids. Following a certain leaching period the samples were filtered through membrane filters and the leach add or filter liquid material was then analyzed for Radium-226 by the radon emanation technique, as currently employed by Mr. Rushing in our laboratory.

I would like to present a brief summary of the salient findings of this research.

First of all, we confirmed what had been found by previous works. In terms of maximum permissible concentrations of radium, significant amounts could be leached. It was also found that the most important single parameter controlling the leaching of radium from these materials was the liquid-to-solid ratio. By this I mean, the volume of leaching of liquid per unit amount of solid. In other words, the number of liters of liquid per gram of material.

These studies showed a very low liquid-solid ratios the amount of Radium-226 leached from a given amount of acid-leached mill waste solids was found to be independent of the volume of leaching liquid. At intermediate liquid-solid ratios, it was found the subsequent increase of leaching liquid volume meant large quantities of radium could be leached from the materials. At very high liquid-solid ratios it was found again the amount of radium leached became independent of the volume of leaching liquid.

The liquid-solid ratios which were employed varied from 10 to 1, that is, 10 milliliters per gram up to 10,000 to 1. In this range of liquid-solid ratios the amount of radium leached from the solids ranged between 0.1 percent at the low range up to 40 to 50 percent at the high range. It was also found that the effect of the liquid-solid ratio was greater on tailings from uranium mills, and not quite so great on river sediments.

The effect of the tailings was greater for acid-leach mill tailings than for alkaline-leach mill tailings.

Another factor investigated was the effect of contact or the amount of leaching time on the amount of radium leached. In this case it was found that the amount of radium leached was independent of the contact time after about fifteen minutes.

Consecutive leaching tests showed that after about two or three consecutive leachings of the same solids, the maximum amount of radium which could be removed had been removed by the liquid.

It was also found in conjunction with the consecutive leaching studies that the diffusion of radium from the interior to the surface of the particles was not an important factor in the amounts of radium leached. That is, to bring the interior particles out to the surface.

I might point out this is contrary to what has been found on leaching studies conducted by other people on unprocessed uranium ores.

In this connection I might point out also that processing studies were conducted on the leaching of radium from raw unprocessed ores as compared to waste ore tailings, and it was found that the radium could be much easier leached from waste ore tailings than from raw, unprocessed materials.

Various tests with organic reagents showed barium was the only inorganic cation that had a significant effect on the amount of radium leached.

At concentrations which we would normally expect in natural Western river waters, the amount of barium leached no more radium than would be leached by distilled water.

Various natural river waters were collected from locations in the Basin and the conclusions reached were these:

The studies showed the natural river waters would leach generally no more radium than could be leached by distilled water.

The effects of temperature in a range of from 2 degrees Centigrade to 25 degrees Centigrade were also found not to be important in the leaching of radium.

In summary, I might say, as I did at the beginning, that the major and only important factor in a leaching of radium from these materials seems to be the liquid-to-solid ratio, or, in another term, the amount of pollution which you give the solid material.

Thank you.

THE CHAIRMAN: Thank you. Let us see if we have any questions or comments. I don't know if I fully understand this.

You apparently have two extremes, and I can understand that, but I don't know why isn't there a continuum? As you say, given a liquid-to-solid ratio, why does it taper off when you add still more liquid?

MR. SHEARER: I might demonstrate it briefly by putting a general type of curve which we observe on the board. For simplicity's sake, the volume of leaching liquids, or the given quantity of solids versus the amount of radium leached, is here. In this case I am speaking about waste ore tailings from uranium mills. We find at very low liquid volumes for a given quantity of solids we have a curve something like this to begin with, but the amount of radium is independent of the volume there. So long as we have enough volume to wet the solids.

As we begin to increase our volume a slight amount, we get a very rapid increase in the amount of radium which is leached out with a small addition of volume to the given quantity of solids. At a certain point at a very high liquid volume, let us say in the neighborhood of a one-gram sample, in the neighborhood of three liters, or three thousand milliliters, we find with a subsequent addition of volume we have a plateau reached in which we get no more radium. It is governed primarily, we think, by the amount of radium available in the solids to be leached.

Does that explain it?

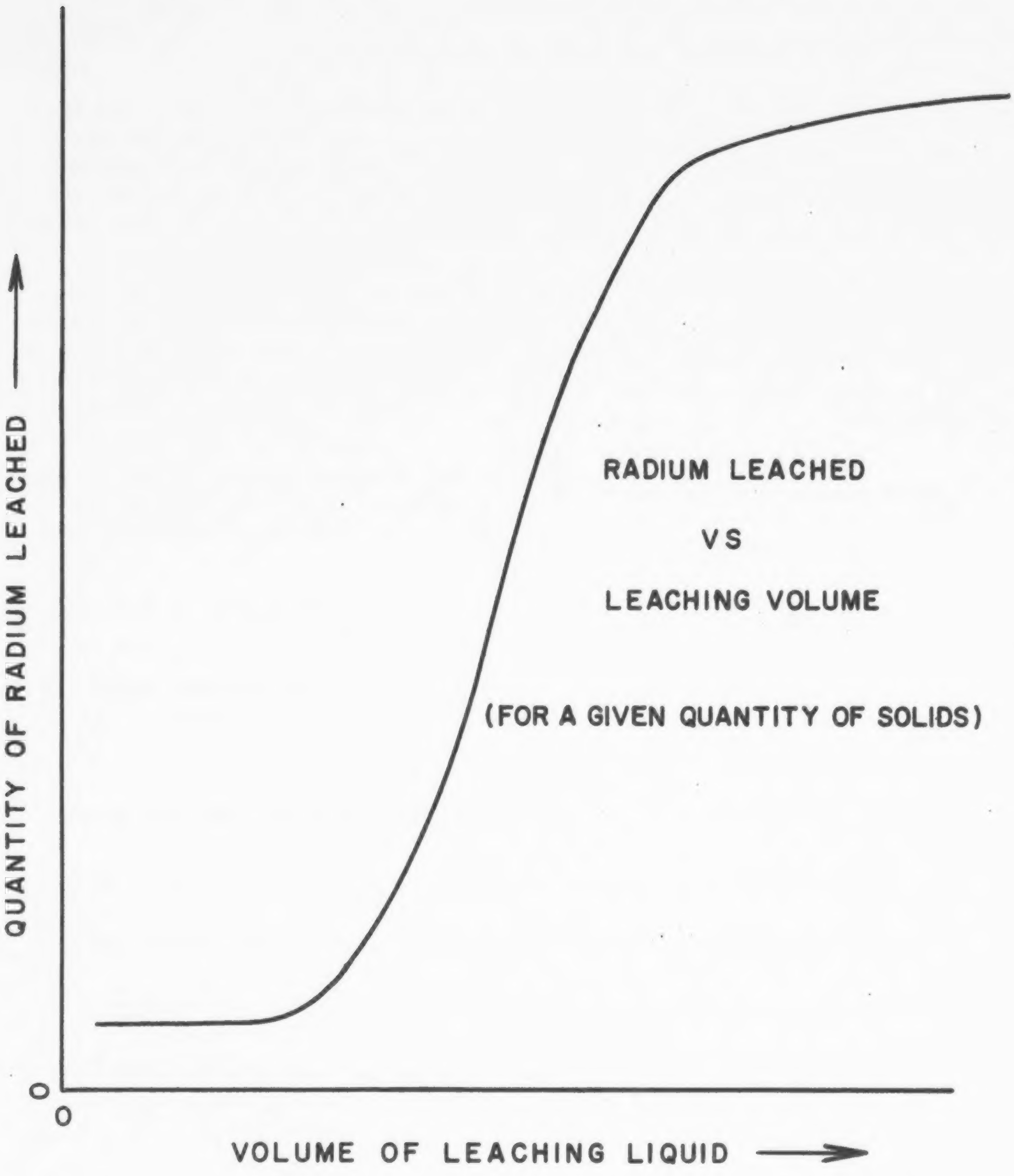
THE CHAIRMAN: Yes. I wonder if you could make a drawing of that and submit it for the record?

MR. SHEARER: Yes.

THE CHAIRMAN: Because that chalk drawing won't show up.

MR. SHEARER: Yes.

(The drawing referred to is as follows:)



RADIUM LEACHED

VS

LEACHING VOLUME

(FOR A GIVEN QUANTITY OF SOLIDS)

THE CHAIRMAN: Now let us see if I can explain it.

MR. SHEARER: I might make one other point.

THE CHAIRMAN: Make your point first.

MR. SHEARER: This was for a given quantity of solids. For the same curve, regardless of the quantity of solids, whether we had one-tenth of a gram or five grams of solids, we still got no more radium leached. In other words, these curves essentially fell on top of each other under certain volumes, and once we got past the volume they began to deviate off, depending on the amount of solids.

THE CHAIRMAN: What you are saying, as I understand it, in other words, is that as you add water to something which would contain radium, let's say uranium, there is a critical point where the leaching picks up moderately; but as you add more water it does not go on indefinitely, but it hits a plateau, and that is the critical point which you think is significant.

MR. SHEARER: I think this is what is significant: I feel of the radium present with the solid there is only a certain maximum amount which can be leached from those solids by the liquids, and that is what governs the shape of this plateau here.

THE CHAIRMAN: Let's see if I can explain it again. I think this is very interesting. Let us see if I understand it.

Let us suppose you would get very little leaching down here. We would add an amount of water and let's say we add this amount.

MR. SHEARER: Right.

THE CHAIRMAN: And you would get pretty much the maximum amount of leaching.

MR. SHEARER: On general principles. Right.

THE CHAIRMAN: Then I would add, let's say, about five to those, as you have pointed out.

MR. SHEARER: Yes.

THE CHAIRMAN: And what I get is this "X" here and this "X" would leach about the same amount of radium.

MR. SHEARER: Generally about the same.

THE CHAIRMAN: Generally about the same.

MR. SHEARER: I might point out in this connection, it might be of interest to the Conferees and the people in the audience that I made a brief study of the liquid-to-solid ratios of suspended sediment at various locations within the Basin. I found during low flow periods that the liquid-to-solid ratio of suspended sediment, or sediment being transported, averaged around 20,000 to 1. When you consider both low flows and high flows taken together the liquid-to-solid ratios range from 70 to 1 up to 500,000 to 1.

MR. WILLIAMSON: I would like to ask a question for clarification here. Units of radium are units, and not concentrations?

MR. SHEARER: Right. Units of radium. Total radium leached.

MR. WILLIAMSON: And not a concentration?

MR. SHEARER: Right.

MR. BONDERSON: Maybe you covered this and I missed it. In your studies did you investigate the relationship of volume to surface area of the materials?

MR. SHEARER: No. I did not. In an indirect way I did this by conducting leaching studies with various particle sizes, from a given ore tailing sample sediment, and found the most radium was contained in the smallest particles, and most radium was leached from the smallest particles; but other than that, I didn't do any volume to surface comparison.

MR. BONDERSON: Thank you.

THE CHAIRMAN: Thank you very much, Mr. Shearer. By the next time we will probably be calling you doctor.

At this point I think it would be wise if we took a ten minute recess. We do have a full program and we would like to come back promptly, if possible.

THE CHAIRMAN: Mr. Nasi.

MR. NASI: Mr. Chairman, this morning we did not introduce some of the Federal representatives here for the reason that they are to appear this afternoon and give some presentations in behalf of their respective agencies. I would like first to call on Mr. Kirk M. Sandals, the River Basin Representative of the Pacific Southwest for the Department of Agriculture. Mr. Kirk M. Sandals.

MR. SANDALS: Thank you.

This statement is intended to briefly identify one principal agricultural water pollution problem in the Colorado River Basin, and make reference to some work of the United States Department of Agriculture related thereto.

The United States Department of Agriculture recognizes the need for intensive effort to reduce harmful effects of water pollution, soil contamination and resulting impaired production of crops, livestock and wildlife. Dissolved salts, suspended sediment and turbidity are among the principal impairments of water quality. Wherever irrigation is practiced, the accumulation of salts and toxic materials in soils is one of the great hazards. Use and reuse of water for irrigation ordinarily results in an increase in dissolved solids in return flow and thus aggravates water quality problems for other users.

The Department is fully aware that agriculture is the principal industry in the Colorado River Basin and also is the Basin's major water user. Salinity pollution usually is identified as the most important water problem affecting the agricultural industry in the Basin.

This problem was given great recognition in 1937 when there was established at Riverside, California, a Regional Salinity Laboratory of the United States Department of Agriculture. This laboratory, which now is administered by the United States Agricultural Research Service, cooperates with the Experiment Stations of the several State Universities in the Colorado River Basin and with the Experiment Stations of State Universities in other western States. It also cooperates with other Federal agencies. The Salinity Laboratory and cooperative work of State Experiment Stations has produced vastly important technical information in the field of salinity water pollution and soil contamination in agriculture. It also has provided a training ground for scientists, some of whom are of national and international reputation.

Other agencies of the Department, such as the Economics Research Service, the Forest Service, and the Soil Conservation Service, have important roles in the Colorado River Basin in connection with salinity water pollution control. The Economics Research Service at this time is working with the Public Health Service, and a representative of the Economics Research Service has a statement to make at this Conference. A representative of the Forest Service also will make a statement. Irrigation farmers in Soil Conservation Districts are assisted by technicians and scientists of the

Soil Conservation Service in applying irrigation and drainage water management improvements. In this effort they must constantly deal with varying degrees of water pollution and soil contamination. Credit and cost-sharing to further the interests of improved water management are available from the Farmers Home Administration and the Agricultural Conservation and Program Service.

The United States Department of Agriculture uses the working tools of research, extension, technical and financial assistance and credit to reduce harmful effects of water pollution and soil contamination throughout the Colorado River Basin. In this task, the Department furnishes and desires wholehearted cooperation and inter-agency coordination within the limits of available funds and personnel. Further, the Department has great interest in the Federal-State effort of the Public Health Service and the several State Health Departments which are now working on the Colorado River Basinwide Water Pollution Control Project.

We appreciate the opportunity to make this statement and to participate in this Conference.

THE CHAIRMAN: Thank you. Are there any comments or questions?

Mr. Nasi.

MR. NASI: Dr. Clyde E. Stewart, Agricultural Economist at Logan, Utah, with the Economic Research Service of the Department of Agriculture, indicated his interest in making a statement for that Service. Dr. Stewart.

DR. STEWART: Thank you, Mr. Chairman.

I want to make a few general comments about activities of the Economic Research Service in the Colorado River Basin with respect to the economics of land and particularly water use and development.

I might first note that the Economic Research Service as an agency is only a few days more than a year old, but its components have a long history of research in agricultural economics.

Basically a research agency, the Economic Research Service was set up as part of an agricultural economics group to integrate economics research that was scattered among several agencies in the United States Department of Agriculture.

Customarily our farm economics research is conducted in cooperation with State Universities and Colleges and most of our field personnel are located at these institutions. With respect to our program in the Colorado River Basin, several staff members have been headquartered at Salt Lake City.

Our activities in the Colorado River Basin are of four general types:

1. Reappraisal of direct agricultural benefits on participating projects under the Colorado River Storage Project Act; these investigations will likely be terminated in the near future.

2. Economic investigations in the Gunnison Basin of Colorado being carried out as an integral part of a United States Department of Agriculture-State of Colorado survey of water and related land resources.

3. Regular research programs cooperative with State Experiment Stations.

4. Conduct of a Basin-wide economic base study in cooperation with the Associated Rocky Mountain Universities under cooperative agreement with the Public Health Service.

Reappraisal of Benefits

In 1956, the President directed the United States Departments of Agriculture and Interior to cooperate in a reappraisal of direct agricultural benefits on participating projects in the Upper Colorado River Basin. The Economic Research Service has been responsible for the economic analysis for the Department of Agriculture. To date, reports have been prepared for the Vernal Unit of the Central Utah Project, and for Seedskadee, Paonia, Smith Fork, Silt, Hammond, Emery County, and Florida Projects. A substantial amount of analysis has been done for the Lyman Project.

The major investigative efforts associated with these appraisals have been cooperative. For example, economists of Economic Research Service and the Bureau of Reclamation have used the same field schedule and have worked together in the field and in the office in the collection and analysis of data. In the process, different backgrounds and points of view in the two agencies have merged to yield a more adequate and efficient analysis.

Economic Investigations in the Gunnison River Basin

Investigations in the Gunnison River Basin are cooperative between the State of Colorado and the United States Department of Agriculture. The Economic Research Service is responsible for the economic analysis and for representation on the United States Department of Agriculture Field Advisory Committee. The scope of this program is briefly noted in the objectives stated in the Plan of Work:

> 1. Identify desirable patterns of water and related land use, management and development to meet future requirements.
>
> 2. Identify possible modifications of the pattern of water and related land use, management and development.

3. Identify and evaluate major obstacles to achievement of desirable patterns.

4. Identify the manner and extent to which the United States Department of Agriculture programs can contribute.

5. Outline additional actions which would help to attain Basin-wide objectives regarding use of water and related land resources.

Regular Research Activities

The scope of our research program carried out in cooperation with State Agricultural Experiment Stations in the Colorado River Basin is indicated by project titles for research in water economics currently in progress:

1. Legal aspects of water rights in the West.

2. Resource development with special reference to groundwater use and the Desert Land Act.

3. Long-term outlook for Western agriculture.

4. Profitable farm adjustments to limited irrigation water in the Upper Colorado Basin.

5. An economic study of values of water for irrigation and competing uses in the Upper Colorado River Basin.

Colorado Economic Base Study

During the current fiscal year, the Economic Research Service has cooperated with the Associated Rocky Mountain Universities and the United States Public Health Service in initial phases of an economic base study for the Colorado River Basin. The ultimate objectives of the research from the standpoint of the Public Health Service relate to water quality. However, analyses by the Economic Research Service and the Associated Rocky Mountain Universities will stop somewhat short of quality problems, although this research is basic to comprehensive planning with respect to water quality. Economic Research Service is investigating the agricultural industry in the Basin while Associated Rocky Mountain Universities is concerned with other segments such as people, industry, and recreation.

Tentative objectives of the agricultural segment are:

1. To develop a regional model by sub-basins that will estimate production, costs, and income effects of alternative uses and increments of water in agriculture.

2. To identify desirable patterns of water and related land use and development to meet future requirements for agricultural production with a minimum expenditure of economic resources.

3. To estimate for the Basin and by sub-basins, water requirements and net losses for agricultural purposes in 1980 and 2010.

4. To identify and evaluate economic and institutional obstacles to attainment of desirable patterns and requirements for land and water use within agriculture.

Agriculture is the major user of water in the Colorado River Basin. Total requirements for this use, losses from production and on-site uses, quality needs for agricultural purposes, and the effects of agricultural production on water quality give prominence to a study of the agricultural segment.

The off-site aspects of water use are so important that analysis usually must be on a physical and economic basis that is broader than individual projects. This economic base study will develop, by sub-basins for the Colorado River Basin over a period of several years, inter-industry input-output models that will show the economic growth that could result from various alternative combinations of water uses in the Basin and that will estimate future needs for water by major industries and sub-basins.

Economics research in land and water resources problems is oriented to the improvement of decisions by individuals, groups, and public institutions in the development and use of these resources. The important emerging problems in land and water result from the increased demand and competition for natural resources among various major uses. Rapid urbanization, industrialization, and enlarged recreational pursuits have intensified this competition.

Problems also exist within given major uses, e.g., agriculture, with respect to the most efficient uses of present and additional supplies of land and water. An underlying common objective of the four activities listed above is a contribution to the solution of these problems through the identification of economic patterns of resource use and development, and the minimization of the economic and social costs and dislocations associated with adjustments in resource use.

Thank you very much.

THE CHAIRMAN: Thank you. Are there any questions or comments? If not, Mr. Nasi.

MR. NASI: Next we have from the Department of Agriculture a man whose name is not listed, unfortunately, on the agenda, Mr. Walter F. Megahan, Hydrologist with the Watershed and Multiple-Use Division of the Forest Service, United States Department of Agriculture, in Ogden, Utah. Mr. Megahan.

MR. MEGAHAN: Thank you, Mr. Nasi.

I would like to give a brief statement of the Forest Service's interest in the portions of the Colorado River.

The Forest Service, operating under the basic policy of sustained yield and multiple-use management, is necessarily concerned with the quality of the water coming from national forest lands. Of primary concern is erosion and the subsequent downstream sedimentation. National forest lands comprise about 15 percent of the total Colorado River drainage, yet approximately 75 percent of the total flow originates from these lands. Thus, the proper management of forest resources has a decided effect on sediment-caused pollution problems in the tributaries and main stream of the Colorado River.

Any natural area may be prone to accelerated erosion when the normal ecologic and edaphic balance is disturbed by man's use. An extensive Forest Service research program is continually revealing ways in which an area can be managed for maximum use without undue soil loss. This has led to a Forest Service program of preventive and corrective measures to meet this end.

Preventive measures consist of managing uses so that erosion is within the limits of what is considered to be "normal" for an area. A good share of Forest Service administration is directed toward this goal. A few examples of procedures used follow:

1. Logging is being deferred on areas of high erosion hazard until more suitable logging methods are developed. On areas that are logged, definite directives provide for minimizing soil disturbance. This is accomplished through planning, supervision, and post-sale treatment.

2. A system of range analysis is used to determine the kinds and numbers of animals that can grace an area without deterioration of the soil resource.

3. All road construction must meet standards regarding grades, size of culverts, ditching, etc., which provide for maximum road stability.

In many areas, active accelerated erosion has necessitated corrective measures to alleviate undesirable situations. Accelerated erosion may be directly man caused, for example, by past overgrazing or improper road construction; or causes may be fortuitous in nature, such as fires or insect attacks.

Treatment measures applied vary with the particular situation. Some of the factors considered are: the direction of management for the area, the condition of the area, the soils, slope, and elevation of the area. Various methods of treatment are used including: contour trenching, furrowing, seeding, gully plugging, road cross ditching and outsloping, road obliteration, and many others.

In Fiscal Year 1962, in addition to funds expended for watershed protection as part of the normal multiple-use management program for the area, $44,000 was used for direct watershed improvement measures on national forest lands in Utah and Wyoming within the Colorado River watershed. For this same period, expenditures for similar work on all national forest lands within the Colorado River drainage was probably in excess of $200,000. The Forest Service is also concerned about the potential for stream pollution from recreation use of the national forests.

"Operation Outdoors" was started by the Forest Service in 1958. The primary objective of this 5 year program is to rehabilitate existing recreation facilities to insure that they are usable and safe. The safety of downstream water users as well as those using the sites themselves is considered. Toilets and sewage disposal fields are built to protect public health. In most small campgrounds, watertight toilet pits are constructed. These are pumped out periodically and the wastes dumped at community disposal plants or in pits located so as not to endanger public health. At large sites, septic tanks and flush toilets are provided if soil conditions permit.

The second objective of "Operation Outdoors" is to provide additional accommodations to relieve the pressure on overused campgrounds and to provide facilities at heavily used undeveloped sites, which in some cases can threaten the water supply of nearby communities. Since most recreation is water oriented, adequate sanitation control is particularly important at reservoirs, lakes and streams - specifically those which provide water for downstream consumption.

At present, most existing campgrounds have been rehabilitated and meet sanitary standards. There is still need for additional facilities to meet the increasing demand of recreationists. Provision for these new developments was made in the "Development Program For The National Forests" transmitted to Congress by President Kennedy in September.

Many facilities to serve recreationists on the national forests are provided by concessionaires who operate under permit from the Forest Service. Included are: resorts, organization camps, marinas, and other commercial public service facilities. Permits issued for the operation of these require that Forest Service sanitary standards be met. In addition, they provide that the owner meet the requirements of State, county, or municipal laws and regulations.

In summary, national forest lands are managed to maintain stream flows as free from pollution as possible, regardless of whether the pollutant is the result of soil erosion or improper sanitation facilities. Thank you.

THE CHAIRMAN: Thank you, sir.

Are there any comments or questions? If not, thank you very much.

Mr. Nasi.

MR. NASI: Next we have representing the United States Atomic Energy Commission three gentlemen. I do not know whether one or all will speak.

Mr. Donald Nussbaumer, Chief of the Source and Special Nuclear Materials Branch of the Division of Licensing and Regulation, will speak for the Atomic Energy Commission.

MR. NUSSBAUMER: Thank you, Mr. Nasi.

We appreciate the opportunity of attending the Third Session of the Conference on Interstate Pollution of the Colorado River and Its Tributaries.

The Atomic Energy Commission's regulatory program as it relates to the uranium mills has been described at the previous two sessions of this Conference. It is the responsibility and objective of the Commission to assure that exposure of individuals in restricted and unrestricted areas to concentrations of radioactive material does not exceed the limits of 10 CFR, Part 20, "Standards for Protection Against Radiation." The Atomic Energy Commission will continue to take whatever steps that are necessary to assure that mill operations are conducted in compliance with Commission regulations and will not endanger public health and safety from radiation hazards.

The milling or uranium ore results in the production of large volumes of liquid waste which contain in addition to various toxic chemicals, concentrations of radioactivity in excess of those concentrations permitted to be released in unrestricted areas by 10 CFR, Part 20. The typical method employed by the mills to contain such liquid wastes is the use of earth dam retention systems. These systems have not always proven satisfactory as evidenced by a limited number of ruptures which have occurred in the past. The Atomic Energy Commission is looking closely at the integrity of these earth dam systems in connection with the issuance of licenses to uranium mills and renewal of such licenses. The following kind of information is being requested on such structures:

1. The geological, hydrological and topographical characteristics of the surrounding area which affect the degree to which liquid effluents may reach surface or subsurface water by seepage or overflow.

2. Drawings showing the layout in plan, typical cross-sections of the dam showing the design and, if applicable, anticipated future extension.

3. Embankment design information including dam height, top width,

side slopes, freeboard, seepage control, protection of embankment surfaces and foundation design.

4. A design analysis of the integrity of the proposed structure based on such factors as soil tests, geologic exploration, foundation materials and characteristics of fill.

5. Construction methods and specifications.

6. Conditions that might lead to accidental release of the waste, the environmental effects of such release and proposed program of inspection and maintenance to prevent such an accidental occurrence.

In connection with the evaluation of these earth dam systems, the Atomic Energy Commission is preparing proposed regulations for publication in the Federal Register to establish specific engineering criteria to assure that these retention dams will be adquately constructed and maintained. These regulations are being coordinated with a similar effort by the Public Health Service, and we intend to coordinate both of these efforts with the States represented at this Conference, as well as other interested States. We, of course, will be particularly interested in obtaining the comment of the uranium mills on these proposed criteria. The criteria will specify the information that must be submitted for Atomic Energy Commission approval where earth dam retention systems are employed and will identify the factors that the Commission will consider in approving such systems. The criteria will be necessarily general in some areas due to the variety of earth dam design and the different types of material available for construction. However, where possible, numerical values will be assigned to particular features such as side slopes, freeboard, and top width. The overall objective of these criteria, of course, is to provide reasonable assurance that earth dam retention systems are constructed and maintained in accordance with sound engineering practices so that the risk of dam failure due to anticipated conditions is held to a minimum.

In addition, we are sending to each licensed uranium mill a letter which proposes that their license be amended to require specifically that ruptures in earth dam retention systems which result in release of the waste material to unrestricted areas be immediately reported to the Atomic Energy Commission. The Commission will then promptly notify the appropriate State official. A copy of this letter will be sent to the Conference Chairman, Mr. Stein, for inclusion in the record of this Conference.

The Atomic Energy Commission desires to work closely with interested Federal and State agencies on matters relating to our regulatory responsibilities and wishes to cooperate in this study in any way that it can. We would again like to express our appreciation to the interested Federal and State agencies for the cooperation and assistance they have furnished us.

Thank you.

THE CHAIRMAN: Thank you.

Are there any comments or questions?

MR. NASI: Can you tell me, sir, Mr. Nussbaumer, if there will be other representations from the Atomic Energy Commission?

MR. NUSSBAUMER: Yes, I believe Mr. Van Blarcom.

MR. CALDWELL: Are these being developed now -- these studies?

MR. NUSSBAUMER: Yes.

MR. CALDWELL: When will they be developed?

MR. NUSSBAUMER: I think in probably sixty days.

MR. NASI: Mr. Ernest C. Van Blarcom of the Division of Raw Materials, United States Atomic Energy Commission.

MR. VAN BLARCOM: Mr. Chairman and Conferees and fellow warriors.

The Commission-owned uranium ore processing mill at Monticello, Utah, was closed as of December 1959, because the facility was no longer needed to process ores from that vicinity. During the years that this mill operated, approximately one million tons of tailings had been accumulated on the mill property. These tailings were stored in several piles located and constructed in a manner to permit the clarification of the liquid portion for re-use in the mill circuit and to control the necessary bleed-off of clarified wastes to the South Creek - Montezuma Creek system.

During the last few years of the mill operation it was discovered in studies carried out in the Commission's laboratories that the radium content of the ore tailings, which amounts to only about one part per billion, was slightly soluble in water and that effluent liquors from the tailings might contaminate the neighboring stream with radium. Studies were undertaken from which a process was developed for the purification of effluent liquors to remove their radium content. This procedure was incorporated in the mill process during the last year of operation.

At the present time it appears that some tailings which have washed into the stream remain in the stream bottom for a few miles downstream and that the flowing water tends to dissolve radium from the sediment. The stream flow is estimated to range up to about 10 cubic feet per second during the spring run-off, but is usually much less than that. Under these conditions the dissolved radium is easily detectable in water samples. South Creek is an intermittent stream that flows about three miles across private property before it drops into Montezuma Canyon. At times the only water flowing is that from Monticello City sewer disposal system. Its use for cattle and irrigation is limited and it is not fit for human consumption because of the sewage contamination.

Last fall work was begun to further control seepage and wind and water erosion from the tailings piles. This work included grading the piles to reduce their height, placing rock and soil on the sloping sides and top, and seeding in order to stabilize the surfaces. Winter weather interrupted the progress of the work but it was resumed this spring. It is still in progress. The recent water and sediment samples obtained in the vicinity of the mill were collected in November 1961 and April 1962, both of them during periods when this work was in progress. It is therefore suspected that the radium concentrations found in the samples are attributable in part to the fact that the tailings piles were being disturbed at these times. In any case, the sample results to date do not reflect the effectiveness of the work that has already been done. Monthly sampling of water and sediment upstream and downstream of the mill was begun in February to determine the effect of the recent improvements. When the problem has been more clearly defined, alternative solutions may become apparent and any necessary additional corrective action will be taken.

Thank you.

THE CHAIRMAN: Thank you.

Are there any comments or questions?

Let me make one comment and see if this is correct. I was not quite sure whether this had application until the problem was more clearly defined.

As I understand the position of the Atomic Energy Commission at Monticello, you are taking this action of banking and seeding, and so forth, that you have described, and after this is completed there will be an evaluation on what effect that work has had?

MR. VAN BLARCOM: That is correct.

THE CHAIRMAN: On reducing the radiation runoff.

MR. VAN BLARCOM: We must do this to evaluate the benefits of the work done.

THE CHAIRMAN: Yes. If there is still a problem, as I understood your atatement, you were to do further work, if necessary, to correct it.

MR. VAN BLARCOM: Certainly.

THE CHAIRMAN: Thank you.

Mr. Nasi.

MR. NASI: Does Mr. Shoen of the Atomic Energy Commission propose to speak?

MR. SCHOEN: No.

MR. NASI: I know Mr. Rodner has been anxious to speak because he did speak briefly this morning. We are very anxious at this time to call on Mr. Jack W. Rodner, Regional Supervisor of Irrigation of the Bureau of Reclamation, Region 3, Department of the Interior.

Mr. Rodner.

MR. RODNER: Mr. Chairman, Conferees, and Ladies and Gentlemen.

Before I go on with my prepared statement I would like to say that Mr. Sponagle sort of led me astray, and I sort of resent it. He told me in a telephone conversation with him in Denver that it was six blocks easy walking distance from the Hotel Utah. The only thing he didn't tell me is that the distance was computed vertically instead of horizontally.

I have been asked to comment on Reclamation's water resources management on the Colorado River.

Water resources Management is becoming more and more a major part of the Bureau of Reclamation's multipurpose planning, construction, operation and maintenance program in the Colorado River Basin.

As our ever-increasing population -- coupled with industrial progress -- places new demands on our water supply, we must not overlook a single opportunity to conserve every available drop. At the same time we must seek to increase our supplies from new sources such as desalinization of sea water and by importation of new supplies from other river basins where water is more plentiful.

The Bureau of Reclamation has embarked upon a water salvage investigations program in the lower Colorado River Basin which should lead to maximum conservation. An estimated one and one-third million acre-feet of water is being taken away from the irrigation, municipal and industrial water users each year largely through losses in the river, losses in unlined portions of canals, and lack of regulatory control at Imperial Dam. Of this quantity, some 800,000 acre-feet could be salvaged if effective conservation measures on the river and canals were undertaken.

Conservation measures which require our immediate attention include channelization of the badly swamped meandering stretches of the Colorado River. Much water is evaporating and transpiring from these swamps which have spread out over wide areas and are heavily infested with phreatophytic growth. Substantial progress has been made in correcting these river stretches as in the Needles, California, vicinity where the Bureau of Reclamation's 20-inch dredge has completed thirty-one and one-half miles of channelized river. Upon final settlement of the Arizona-California boundary and with appropriation of funds, similar work will be done in the Cibola Valley near Blythe. The entire length of the river is being investigated, looking toward a complete channel remedial program.

Reclamation has joined with other Federal and State agencies in scientific research to find effective ways of eradicating the water-robbing phreatophytes along the Colorado River and canals.

A regulatory reservoir at the mouth of Senator Wash on the California side of the Colorado River, one and one-half miles upstream from Imperial Dam, offers opportunities to save water lost to the Gulf of California at certain times. This reservoir would provide additional storage capacity to assist in delivering Colorado River water to users at and below Imperial Dam. Water ordered from the upstream reservoir behind Parker Dam but not needed by the time it reaches Imperial Dam three days later, because of rain or other reasons, could be pumped into the Senator Wash reservoir and released later as called for. The Bureau of Reclamation is investigating this development.

The Colorado River's water is becoming so valuable that we cannot afford to transport it in unlined canals. We envision the time when the unlined portions of the All-American, Coachella and Gila

Gravity Main Canals will be lined or sealed to stop vast quantities of water from being lost to the underground. The Bureau of Reclamation is doing research in the field of lower cost canal lining and is testing chemical sealants in an effort to halt these canal losses.

We are not overlooking the need for re-using water in the overall operations of the river, and to assist in meeting Mexican water treaty requirements during critical water supply periods. Congress made available $110,000 to the Bureau of Reclamation this year to investigate ways and means of utilizing underground water aquifers in the Yuma area for this purpose. The State of Arizona added $10,000 to this fund for this study which will seek to integrate a flow of about 500 cubic feet per second of pumped underground water into the daily water orders for Mexico.

The tremendous additional hydroelectric power which can be developed at Bridge and Marble Canyons in the stretch of river between Hoover and Glen Canyon Dams could play a major role in water salvage in the lower Colorado River Basin. Should a lower Colorado River Basin fund be established, part of the revenues from these potential as well as existing hydroelectric developments might be used to finance conservation programs such as channelization, eradication of phreatophytes, lining and sealing the All-American, Coachella and Gila Gravity Main Canals.

We must literally manage every drop of water from the time it falls on the watersheds as snow or rain until it reaches the farmers' headgates or spigots in homes and factories. In doing this, Federal, State, and local agencies are working together in all fields.

At Reclamation reservoirs, we are doing research into ways of reducing evaporation by use of chemical monolayers.

At Reclamation powerplants, we are releasing in years of short supply only enough water to meet downstream irrigation, municipal and industrial needs. All of this water generates hydroelectric energy and provides other multipurpose benefits including recreation, fish and wildlife.

More than nine million residents in the Pacific Southwest consume the water and the hydroelectric energy produced on the Colorado River. Through maximum conservation, water could be made available for additional millions.

The Bureau of Reclamation is preparing to launch a program of studies leading to better utilization of water after it reaches the farmers' headgate. Regardless of how much water is salvaged along the river and canals, we cannot achieve a full program of conservation unless the water users wisely manage the water.

The Bureau of Reclamation feels that it has evidenced good water management in its principles and criteria governing operation of the Colorado River during the filling of Lake Powell, the new reservoir to be created by Glen Canyon Dam now under construction in northern Arizona. Glen Canyon Dam will begin storing water sometime next year. We think these principles and criteria establish a procedure whereby the reservoirs of the Colorado River Storage Project can be filled to an operating level as quickly as practicable with a minimum of disturbance to water deliveries under existing contractual arrangements.

The good inflow to Lake Mead expected during April-July this year from the heavy snowpack in the Rockies would greatly facilitate these filling procedures for Glen Canyon Reservoir and other Colorado River Storage Project lakes. Our latest estimates indicate the April-July inflow for Lake Mead will approximate 10 million acre-feet this year as compared with only 3,843,000 acre-feet last year which was less than half the 39-year average of 8,200,000 acre-feet. The lowest recorded runoff was 2,247,000 acre-feet in 1934.

The Bureau of Reclamation, representing the Secretary of the Interior, is the custodian of the Colorado River. Therefore, Reclamation assumes the responsibility in taking the lead in managing the river's precious supplies. We shall work with other agencies to carry out every type of conservation activity within reason. And in doing this, we are alert to the need of keeping the Colorado River free of contamination. The once-muddy Colorado River has been desilted by Lake Mead and other reservoirs. As intensity of use increases, constant vigilance by all of us will be needed to keep it useable. We must expect, however, that in the lower reaches of the river increased salinity will follow this more intensive use. Our program must therefore be one of realism, and in harmony with the diversified uses to which the river is put.

Thank you.

THE CHAIRMAN: Thank you.

Are there any questions or comments?

MR. GAHR: Yes.

Mr. Rodner, does this program of better water management that the Bureau of Reclamation is planning to embark upon, envision less return flow volume? What I am trying to say is, is there going to be a determined effort better to utilize the water as applied to the crops? As it is now, we have had to get a lot of water applied to serve only one purpose -- to leach out minerals and return it to the stream.

MR. RODNER: Well, it isn't quite that bad, but that is one of the main purposes of the new program. It is better utilization of the farm and, of course, better utilization of the farm does mean the conservation of water. Personally I am of the opinion that as water grows more precious, we are either going to do it for ourselves, or it will be forced on us, because water is a pretty precious commodity in the Western States.

MR. GAHR: I note your remark that there will be increased salinity.

MR. RODNER: I think that is inevitable because you can't stop all the return flow; and desert soils being what desert soils are, when it returns it is going to return to the river almost always with more salt in it than when it left. I think we can't hope to change that completely.

THE CHAIRMAN: Are there any further comments or questions?

I have just one or two, if I might ask you them, Mr. Rodner.

On your Senator Wash Dams, have you gotten an authorization or an appropriation for the regulatory dams?

MR. RODNER: I beg your pardon?

THE CHAIRMAN: Do you have an authorization by the Congress, or an appropriation for that?

MR. RODNER: We have the money for investigation. We do not have money for construction of the dam. At the present time we are doing drilling there for the dam site and making other investigations as to the possibility of the amount of storage and the holding capacity of the reservoir. We are right in the middle of it, as of today.

THE CHAIRMAN: We have one other problem and I think Mr. Gahr alluded to that. It is one here that we might face up to. We have Mr. Marx here from Arizona and some other people from Arizona, who are already complaining about the salinity of the water in the Colorado River when it gets down there to them. I did not know how Mr. Bonderson in California felt about the quality of the water he is getting in California when the river gets down there. I wonder, and this may be something for discussion and for the Conferees to consider, whether it is the view of the Conferees, or if this is what we have to work on--that the long-range view is an increasing trend to more and increased salinity in the lower reaches of the river. This, I think, very well may be the nub of the problem on the Colorado River. I do not have the information on that, but I certainly do not want it to be construed as disputing your conclusion. However, I think this is a key problem other than the radiation problem, which I think is on the way to solution.

Possibly the Conferees and the people of this river basin have to address themselves to that. I know we have licked that problem and I think we have to lick a similar problem in other areas, which does not deal with salinity, necessarily, but deals with taste and odor materials in the Missouri River. You start at Yankton in South Dakota and you do not have very much problem until you get past Sioux

City, and it begins picking up. Then Omaha and St. Joe, Atchison, Leavenworth and Kansas City. By the time you get to St. Louis there are literally tons of this taste and odor material plaguing the water plant operators there.

In our program we hope we have a solution to that, and that we can reverse the trend. I think this is going to be the problem we are facing in water pollution control, or in better quality management. Inevitably, as we reuse water, if we let things happen as they happen naturally, they are going to get an increase in whatever material there is, as that water works its way downstream.

The key thing here, or the key question in the debate on water quality management and the anti-pollution problem, is if it is to be reversed the reverberations of this will be felt all the way upstream to Wyoming, and it is something we will have to deal with and lick.

Thank you.

MR. NASI: The Bureau of Reclamation, like other Government agencies, has the United States divided into jurisdictions or regions. Region 4 of the Bureau of Reclamation is concerned with the Upper Colorado River Basin, which is the responsibility of Region 4 of the Bureau of Reclamation.

We have here representing that office Mr. C. B. Jacobson, the Regional River Control Engineer.

Mr. Jacobson.

MR. JACOBSON: The activities of the Bureau of Reclamation in the Upper Colorado River Basin were discussed somewhat in detail at the Second Session of this Conference in Las Vegas, Nevada, May 11, 1961. Although considerable progress has been made on these varied activities since that time, this statement is confined essentially to Reclamation's immediate program of initiating storage in the reservoirs of the Colorado River Storage Project. The filling of some 34.5 million acre-feet of new capacity on a stream that flows as little as 4.4 million in some years and as much as 22 million in other years will be quite a feat, and the impacts of such a program are no doubt of interest to each of you.

The object of the Colorado River Storage Project is to effect the control necessary to achieve, in view of compact and treaty commitments to the lower Colorado River system, the fullest possible development of the water resources on the upper Colorado River system. Within the next nine months, we are hopeful of initiating storage operations at three major reservoirs in the upper system; namely, Lake Powell on the main river at Glen Canyon Dam, Flaming Gorge on the Green River, and Navajo Dam on the San Juan River.

On April 4, 1962, the Secretary of the Interior announced the operating principles and criteria whereby the reservoirs of the storage project can be filled to operating levels as quickly as practicable with a minimum of disturbance to water deliveries under existing contractual arrangements. These deliveries pertain essentially to purposes of consumptive uses, power generation, and maintaining of power head at Lake Mead. With regard to the subject of this conference, there will be a bypass of water at each storage site during the filling period to the extent that we anticipate no material change in the pollution aspect of the affected reaches of the river system.

Before discussion each individual unit, first let us look at the general status of the overall program. Progress of contract construction work indicates a possible closure of Glen Canyon Dam in time to store the snowmelt runoff of 1963. This would be preceded by closure at Flaming Gorge Dam in November 1962. We now anticipate closing Navajo Dam after the recession of this year's (1962) big snowmelt runoff. Construction on the Curecanti unit has barely begun, and closure of the Gunnison River at the Blue Mesa Damsite is not scheduled until November 1965.

Glen Canyon power should be on the line in June 1964, whereas Flaming Gorge Power is scheduled on the line in the summer of 1963. Generation should commence at Blue Mesa Dam in June 1966. No power facilities are planned at Navajo Dam, of course.

Glen Canyon Unit

By necessity, closure of Glen Canyon Dam must be effected during the low flow season or the late winter period. A minimum of 1,000 second-feet and at least one million acre-feet per year must be bypassed until a dead storage of 6.5 million acre-feet is obtained in Lake Powell. While dead storage is being acquired in Lake Powell, downstream consumptive uses will be supplied by drawing upon the storage reserves in Lake Mead above the level of rated head on the Hoover powerplant. At the time of closure of Glen Canyon Dam, it is estimated that Lake Mead will contain 23 million acre-feet. That is during the subsequent high-flow period. Thus, a reserve of about 8.5 million acre-feet should be available for this purpose.

Except for extreme circumstances, and these are only three years out of 54, dead storage at Lake Powell should be acquired from the first snowmelt, and in no event would it require more than two years to gain the 6.5 million acre-feet. With average flow conditions sustained for a period of twelve years, both Lake Powell and Lake Mead would fill to conservation levels. With years of abundant water supply, the time would be shorter, and the opposite, of course, would be the case under a condition of deficient water supply.

When Glen Canyon power is placed on the line in June 1964, Hoover and Glen Canyon powerplants will operate together for maximum combined firm production. Releases at Glen Canyon could vary greatly, the normal variation being between 10,000 and 30,000 second-feet, but momentarily as low as 3,000 second-feet.

Should the initial filling of Lake Powell and the other upper basin reservoirs entail a deficiency in the firm power production which otherwise would have occurred at Hoover powerplant without the upstream reservoirs, the Hoover power allottees are to be compensated by equal value in dollars or energy. The criteria provide that dollars taken from the Upper Basin Fund account for such compensation might be returned to the fund following payout of Hoover powerplant in the year 1987.

Flaming Gorge Unit

Flaming Gorge Dam must also be closed during the low flow season. This we anticipate doing in November 1962. We will, however, bypass a minimum of 200 second-feet until probably February 1963. Thereafter, a release of 400 second-feet is contemplated until the powerplant is put on the line in the summer of 1963. There is a 25-percent chance that rated head at Flaming Gorge can be achieved from the first snowmelt, and 75-percent chances are that 90 percent of rated head will then be available. Power operations will then draw upon storage to supplement the low flows of the winter season. This flow, however, would be recaptured in Lake Powell.

Considerable variation in the powerplant discharges must be anticipated at Flaming Gorge. Normally the discharge will range from 1,500 to 4,500 second-feet but momentarily may be as low as 400 second-feet.

Navajo Unit

It is indeed unfortunate that progress on Navajo Dam was insufficient to permit closure in time to capture the snowmelt runoff of this year (1962), which will be nearly average. And, by the way, the average is a damned good year from the experience of the past ten. We have, however, arranged a safe closure of the Navajo Dam after the 1962 flood peak recedes to a flow of 2,200 second-feet. We expect this condition sometime prior to July 1, 1962. A complete shutoff of the river for two days will be necessary before the reservoir rises where a discharge through the outlets in the dam will occur. We will then bypass the river flow up to the following amounts:

May through September	350 second-feet
October	300
November	250
December	160
January	120
February	200
March	250
April	300

Under these conditions, only a minor amount of storage will accumulate during the remainder of 1962. However, we anticipate sufficient storage from the 1963 snowmelt to thereafter provide a capacity of about 537,000 acre-feet, sufficient for recreation use of the reservoir. Any additional water stored will probably be released during the nonrecreation season to assist in filling Lake Powell.

Curecanti Unit

Construction is barely underway on the Blue Mesa Dam, the initial feature of the Curecanti Unit. We anticipate closing Blue Mesa Dam in November 1965. The Blue Mesa powerplant will operate essentially as a peaking plant and will discharge directly into the Morrow Point Reservoir. Construction is scheduled to commence at Morrow Point in Fiscal Year 1963.

Except in periods when there is an abundance of water in the Gunnison River, releases at Morrow Point will average about 1,100 second-feet or more.

The Morrow Point release will care for diversions through the Gunnison Tunnel, which begin about March 20 and increase to about 1,000 second-feet in late summer before subsiding to zero about November 10. In years of normal or above normal flow, the average release will be augmented by large spills mostly in May, June, and July. A flow of at least 100 second-feet would thus pass the tunnel at all times.

We are now reviewing a report on a third feature of the Curecanti Unit at the Crystal site. That report considers the need for additional releases for fish with a minimum 200 second-foot flow passing the tunnel which would increase to 400 second-feet during the summer months of normal or above normal years.

In conclusion, you will note that the procedure of initiating the storage operation of these large reservoirs provides for maintaining a live stream below reservoirs. The flow would be equal to or in excess of past experienced minimums, with the exception of the 2-day shutdown at Navajo. As soon as possible thereafter, the reservoirs will operate to supplement the low flow. In the few instances where pollution exists, this should tend to alleviate the situation. Since the reservoirs themselves become attractive sites for recreation, shore line sanitation is of immediate concern. The Bureau of Reclamation is pleased to work with representatives of the States, the National Park Service, U. S. Forest Service, and the Public Health Service in maintaining the safe usage of these reservoirs and streams.

Thank you.

THE CHAIRMAN: Thank you, sir.

Are there any questions or comments?

If not, thank you very much.

I do not know, but is anyone here who is not really a water man and who did not understand the term "closure" there? It does not mean they shut down the dam.

If there are no questions, Mr. Nasi.

MR. NASI: We have one remaining Federal Agency representative who wished to make a statemant, representing the Bureau of Land Management of the Department of the Interior, Mr. Virgil T. Heath, who is with the Pacific Southwest Field Committee.

Mr. Heath.

MR. HEATH: Mr. Chairman, Conferees and Ladies and Gentlemen.

The first paragraph of my paper sounds as if I am running for office, but I am not. I am going to read it anyway.

It is a pleasure and a privilege to appear before this distinguished group and tell you about the Bureau of Land Management and its pollution control problems and plans. Those of you who have been struggling along for so many years in the field of stream pollution control must be encouraged by the interest now being generated at all levels of government. The dedication of the Public Health Service Colorado River Basin Laboratory tomorrow is indicative that your problems are being recognized.

The Bureau of Land Management administers over 178 million acres of the national land reserve within the United States, exclusive of Alaska and Hawaii. Over 140 million acres of this land is within the States drained by the Colorado River and its tributaries. The geological structure of the land dictates that there will be a great deal of normal erosion. This normal erosion, coupled with the accelerated erosion caused by poor land management practices that date from the mid-nineteenth century, contributes an unbelievable amount of sediment, a form of pollution, to the streams of the area. The Bureau of Land Management is definitely interested in sedimentation and its basic control through proper land management.

The Bureau of Land Management is taking positive action to revegetate deteriorated land areas and prevent further deterioration through control of grazing trespass. Range adjudications are receiving special attention on proper rate of stocking and season of use in order to comply with good range management practices to insure that where possible the vegetative ground cover will rehabilitate itself.

Wild fires of the past have destroyed large areas of vegetative ground cover, leaving the soil bare and susceptible to easy movement by winds and rains. Fires did more than ordinary damage during the Fiscal Year 1961. Recognizing the damage, Congress made a supplemental appropriation of $1,425,000 available to the Bureau of Land Management for rehabilitation of the burned areas before they had a chance to deteriorate badly from erosion by storm damage. Further recognition, and encouraging indeed, is the fact that the Fiscal Year 1962 appropriation contains a generous amount for the rehabilitation of areas which may be burned by wildfire. You can be assured that immediate action to rehabilitate burned areas will prevent a great deal of erosion and the resultant sedimentation of streams.

The Fiscal Year 1961 supplemental appropriation made it possible to control runoff on some lands through terracing, dikes, and the construction of dams and debris basins. Perennial grasses were planted on all major burned-over areas. Forest sites were rehabilitated by planting tree seed or seedlings. The Bureau also used regular management funds to seed perennial forage grasses -- along with other land treatment practices, including pitting, furrowing, and deep tillage to increase water absorption, thus affording greater protection against wind and water erosion. In addition, detention dams, diversions, dikes, and reservoirs were constructed as erosion control measures.

Chemicals have been and are being used to kill insects, rodents, and weed plants. The indiscriminate use of such chemicals can be harmful to fish, animal, and plant life, so careful plans are now being made in advance of the use of chemicals and coordinated with interested agencies and associations to minimize damage.

Erosion control is taken into consideration on logging plans and the location and construction of logging roads. Special precautions are taken adjacent to streams. In Oregon, the City of Oregon City obtains much of its water supply from lands administered by the Bureau of Land Management. Oregon City and the Bureau of Land Management have found through cooperation that timber sales and the construction of logging roads can be accomplished with a minimum amount of damage by the use of proper safeguards.

Meetings have been held recently in irrigation districts of Utah to decide what should be done about the sedimentation and clogging of irrigation ditches by granetic sand. Sedimentation, a problem of long standing, was vividly brought to the attention of irrigators who had recently lined some of their ditches with asphalt. This allowed the extensiveness of the problem to be recognized, as excessive sediment deposits were immediately evident in the newly lined ditches. There is some talk now of bringing suit against the owners of land that contributes to excessive sedimentation when it is due to poor land management practices.

Only last month the Rocky Mountain Oil and Gas Association issued a memorandum to its more than 800 members in five Western States, calling for "closer cooperation with the Bureau of Land Management in minimizing damage to public lands." This is excellent cooperation on the part of industry toward minimizing erosion on the national land reserve.

Secretary of the Interior Stewart L. Udall recently announced a new program designed to aid local governments and nonprofit organizations in obtaining public land sites for public health projects at $2.50 per acre. Under the new procedure they may obtain sites from the Bureau of Land Management to aid in the construction of public health projects, such as hospitals, treatment under research facilities, and water and sewage treatment plants.

Recreational use is becoming an increasing problem on the national land reserve. Areas of overuse with resultant pollution are being recognized. Plans for proper sanitation facilities will be an integral part of any recreation development undertaken by the Bureau of Land Management.

Thank you.

THE CHAIRMAN: Thank you very much. Are there any questions or comments?

MR. NASI: Mr. Chairman, I belive that concludes the presentations by Federal agencies.

We have next on the agenda presentations of reports by representatives of the uranium milling industry.

THE CHAIRMAN: Are there any representatives of the uranium milling industry who wish to make any statements?

MR. GAHR: Yes, sir. I believe there are.

THE CHAIRMAN: Do the States want to call on their individual members when we have the States' presentation, or do you wish to have them come up now?

MR. GAHR: I would suggest they come up now.

THE CHAIRMAN: That is what I would suggest too.

May we have the industry representatives who are here, announce if they would like to make statements now, so we can get started?

MR. GAHR: Mr. Beverly from Grand Junction, Colorado, a representative of the Union Carbide Nuclear Company.

THE CHAIRMAN: Mr. Beverly.

MR. BEVERLY: It is a pleasure to be in attendance at this conference again this year. I wish to thank Mr. William Gahr for his invitation and the opportunity to make a statement at this time.

By the way of a brief review, Union Carbide Nuclear Company has operated five uranium mills located on the Colorado River System. As I mentioned last year, our ore concentrator at Green River, Utah, was shut down in February of 1961. A similar ore concentrator located at Slick Rock, Colorado, was shut down in December of last year. At present, we are only operating three mills in the River Basin. We have been concerned about radioactive pollution for many years and have conducted a rather thorough monitoring program encompassing all mill effluents as well as the rivers above and below the mills since early 1959. In March of this year we reported to the Atomic Energy Commission the results of our 1961 monitoring program. This annual report included approximately 900 analytical determinations of individual radionuclides in the effluent and river samples. It also contained evaluations of the effect of radioactivity on the rivers.

One of the most significant observations which has resulted from the monitoring program conducted over the past three years concerns the soluble radium in the rivers. The data indicate that a large part of the soluble radium being carried by the Colorado River and its tributaries is contained in the rivers above the location of any uranium mills.

The location of the mills operated by Union Carbide has been opportune in making this study, as the Company's mills are all situated above any other uranium mills on the particular streams involved. Quite recently, an ore concentrator was built by another company a short distance above one of our mills. We added a sampling station above this mill in order that we could continue to study the river above any mill sites.

On an annual basis, it has become evident that most of the soluble radium that is carried by the streams comes from the results of the spring snow melt and water run-off. This was discovered when it was noted that radium concentrations in the rivers above the mills did not drop during the run-off when flows were many times higher than during low-water months. In fact, the concentration in some instances increased. As an example, the radium carried by the Colorado River past Rifle, Colorado, according to our figures, amounted to about 2,900 millicuries during the 1961 water year. Of this amount, 2,000 millicuries, or about 70 percent, went down the river during the months of May and June. Evidently, this radium is coming from natural sources, possibly from minute amounts of radium being dissolved from granites, other rocks and soils as they are washed with water during the spring run-off. Another possibility is that the intimate mixing of the river waters with the high load of sediments results in small amounts of radium being dissolved. No doubt the future Public Health Service data will help us clarify this interesting phenomenon of nature.

By way of contrast, the Union Carbide uranium mill at Rifle, Colorado is permitted to release annually 17.5 millicuries of soluble radium in effluents. During the 1961 water year this was considerably less than one percent of the 2,900 millicuries carried by the river over the same period.

The other streams on which Union Carbide mills are located showed the same effect as was noted in the Colorado. The high water flows during the springs, coupled with radium concentrations which did not decrease as would be expected in the case of most dissolved materials, result in relatively higher quantities of soluble radium carried by the streams during April, May, and June.

During the 1961 water year, the Colorado River at Rifle, Colorado, and the Dolores and Yampa Rivers at their mouths carried some 4,100 millicuries of radium. Adding to this the 1960 water year figure for the Green River, at Green River, Utah (this sample station was discontinued in March, 1961), of 2,900 millicuries, these four rivers carry a total of approximately 7,000 millicuries, or about 7 curies, of soluble radium per year.

At the location where the samples were taken, these rivers represented 60 percent of the 1961 water flow of the Colorado at Grand Canyon, Arizona. The effluents from Union Carbide's mills entering these streams contained about 60 millicuries of soluble radium (this includes 1960 figures for Green River mill) or, again, less than one percent of the soluble radium in the rivers above the mills. Thus, from our figures, it appears that the radium contribution to these rivers from the uranium mills is small compared to the contribution from natural sources.

In addition to disposal of radioactive wastes, we are concerned in general about possible pollution of streams by various chemicals and their toxic effects. Some of the alternate disposal methods we are studying include evaporation seepage ponds, deep-well injection, disposal in abandoned mines, recycling effluents, and various neutralization schemes.

The pollution studies by the United States Public Health Service are of great interest to us. We are following the work closely and cooperating where we can be of assistance. We will continue close liaison with the Atomic Energy Commission with regard to radioactive material in mill effluents.

THE CHAIRMAN: Thank you. Are there any questions by the panelists?

MR. GAHR: I would like to present a few questions to Mr. Beverly. I know that the company has made a good many efforts to try to overcome these problems, and I wonder if you would take the time to elaborate on at least the general method, and if you are giving some attention to disposing of it by the deep-well method too?

MR. BEVERLY: In the Uravan, Colorado, mill we have been working on an alternate solution, or a joint solution since January 1, 1961, over a year ago. We have been at it continuously. As I mentioned, we have investigated a number of different methods, each one of which appeared to be the answer, and we went on quite an extensive testing program to test each one. As for mines, unfortunately they held water extremely well and would not seep at all. We hired one of the better known consultants on the deep-well injection method. It involves quite a long program in studying this, and it seems the formation underneath us was not permeable enough to take this effluent.

We mentioned recycling of effluents. The United States Bureau of Mines followed that and we followed it closely, and did some of our own test work; and we are making another evaluation of the evaporation seepage pond method, which looks encouraging to date, but so do all of the other programs. I should hope that at the next annual meeting I can report that we have found a satisfactory solution to it. We have certainly been working on it, but have not quite found the answer.

I mentioned that we did meet with all of the State agencies involved in Colorado last fall, which was quite valuable, and discussed all of these various methods. We discussed it with the Atomic Energy Commission and various people from the Public Health Service.

There is one point I want to mention here. In regard to Uravan, we do not use an organic process there, so I know the toxicity is not from that, referring to toxicity. Does that answer the question?

MR. GAHR: Thank you. Yes.

THE CHAIRMAN: We also had a problem here, we learned from Dr. Tsivoglou's statement, about a radioactive discharge from the Uravan mill. Do you have any comment on that?

MR. BEVERLY: As I mentioned at last year's conference, in 1960 we put in a radium decontamination circuit and reduced the amount of radium in the effluent by a range of 95 percent reduction. The river downstream last year, I think was under the 3.3 micro-microcuries per liter all the year. How much of this effect may be from the past history, it is hard to tell. We will continue to try to reduce this further, and possibly something like disposing of it in a deep-well injection method underground would solve any further radioactivity problems, as well as the chemical.

THE CHAIRMAN: As I understood Dr. Tsivoglou, he indicated the Uravan mill is one of the two places in the Basin where, if you ran your finger down the radioactivity counts, you found them a little higher.

MR. BEVERLY: Yes. They were higher than the 1 micromicrocurie.

THE CHAIRMAN: That is correct, but I think I emphasized over and over again -- and I know your company particularly has been very cooperative, as have the other companies represented -- but what I am suggesting is that it might be possible for you and the Atomic Energy Commission representatives, and Dr. Tsivoglou, in a technical way to explore this to see if there is a problem, so you can evaluate what can be done. How do you feel about that?

MR. BEVERLY: Yes. As I say, I think we have taken about all the steps we know how, technically, to do right away. If we go to an entirely different disposal scheme, it should help find some answers. The barium treatment circuit we introduced two years ago reduced it to the point where the effect on the river is relatively small. As I say, we were trying definitely to achieve getting the river down to the drinking water specs.

THE CHAIRMAN: I do not know that we can possibly make a judgment without using as a basis the technical information put in here, but I think it may be advisable if on a technical basis you could consult with the Agency's representatives at an appropriate time and with Dr. Tsivoglou perhaps, to get their notions of what may prove to be the cause of the situation, if there is a situation existing.

MR. BEVERLY: This is true, and we have been working very closely with both the Agency and Public Health in the course of every year, between the meetings. I see both agencies, or members of them, frequently, and we are trying to follow all the technical developments. We are very interested in their crops downstream also.

MR. GAHR: I might say, Mr. Chairman, that there are reports of investigative work done bythe Company under Mr. Beverly's offices and direction. It is too bad we do not have the opportunity to go into all of this.

THE CHAIRMAN: I am not saying anything about that, but suggesting there are two operations in any kind of waste disposal. One is in getting the method that will work, and the other is operation and maintenance. I would not doubt that all of them have been explored, but the question is, for example, whether the ponds are holding; are they seeping. There are various questions.

MR. THATCHER: Did I understand correctly, Bob, the figures you gave were dissolved radium figures?

MR. BEVERLY: Right.

MR. THATCHER: Were any determinations made on suspended radium?

MR. BEVERLY: We made periodic determinations on our effluents of release from suspended material. We have not done it on rivers, and have not made sediment surveys of rivers.

MR. THATCHER: The 60 millicuries you mentioned was the dissolved portion?

MR. BEVERLY: Right.

MR. THATCHER: Thank you.

THE CHAIRMAN: Thank you very much. If there are no further questions, may we have Mr. Brinker? Mr. Brinker is an old friend. They have done a magnificent job. We are glad to have you Mr. Brinker.

MR. BRINKER: My name is Fred Brinker. I am with the Vanadium Corporation of America, Durango, Colorado.

The Vanadium Corporation of America welcomes the opportunity of being present at this meeting to present some data on the Animas River.

The Vanadium Corporation of America operates a vanadium-uranium

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processing mill at Durango, Colorado on the Animas River, which is a tributary of the Colorado River. In addition, the Vanadium Corporation of America operates a concentrator at the Monument No. 2 mine in Monument Valley, Arizona, from which there is no drainage, and a concentrator at Naturita, Colorado, on the San Miguel River, which is a tributary of the Dolores River, and which in turn is also a tributary of the Colorado River. At this time the quantity of the effluent at Naturita is very small and we do not have sufficient records to give any data.

In April 1958, under the provisions of the Federal Water Pollution Act, a meeting was held in Santa Fe, New Mexico, on the matter of the pollution of the Animas River. A survey was made in the summer of 1958, the results of which were published in May, 1959, by the United States Public Health Service.

The people of Aztec and Farmington, New Mexico (a population of approximately 30,000), take their domestic water supply from the Animas River; therefore, the quality of this water is very important.

Over a period of years the Vanadium Corporation of America has spent very substantial sums of money and put forth much effort to improve the quality of the Animas River water. These efforts have included various types of settling ponds, barite treatment plant for precipitating radium, and evaporation and seepage ponds for one of our effluents containing about 70 percent of our total radioactivity.

There have been numerous surveys made on the Animas River, and no doubt most of you are familiar with the results. However, below we are showing the results which indicate the improvement made during this period. The figures are shown in micromicrograms Radium-226 per liter. That is the Guide Level Figure. The MPC as stated in Part 20 of the Atomic Energy Commission's regulation dated January 1, 1961, for river water, is 10 micromicrograms of Radium-226 per liter. This Guide Level figure was changed on January 1, 1961, from 4 to 10.

Samples taken at the Colorado-New Mexico State line during the survey of the United States Public Health Service in the summer of 1958. - 7.6

Samples taken at the above location during the summer of 1959 by the United States Public Health Service. - 1.4

Samples taken at the above location during the summer of 1960 by the Vanadium Corporation of America. - 0.7

Samples taken by the Vanadium Corporation of America at the above location for the full year of 1961. - 0.4

Vanadium Corporation of America samples have all been analyzed by Radiation Detection Company of Palo Alto, California.

It must be borne in mind that in looking at any of these figures the method of analyzing for small amounts of radium in water in the lower ranges is still probably an approximation. However, we can say, regarding the Animas River water at the Colorado-New Mexico State Line, that it is approaching background. In the report of the 1959 surveys on the Animas River by the United States Public Health Service, a statement was made on page 44 regarding an estimate of the reduction of dissolved radium contained in these waters due to the Vanadium Corporation of America program and we are glad to report that our 1961 results were below this estimate.

We have some total soluble radium figures for 1961 that may be of interest and which are as follows:

	Miligrams Ra^{226}
Total radium content for the year 1961 in Animas River above Vanadium Corporation of America mill. (Of the above amount 63 percent was contained in the high water months of May and June.)	143.4
During 1961, Vanadium Corporation of America effluent added to the river.	33.0
At the Colorado-New Mexico State Line Vanadium Corporation of America results showed	196.7

If we add 33.0 to 143.4 we get 176.4 which we consider a fair check with the results at the Colorado-New Mexico State Line of 196.7. Using the calculated figure of 176.4 of dissolved radium, we arrive at results that indicate 81 per cent of the dissolved radium for 1961 in the Animas River was from natural sources and 19 percent from Vanadium Corporation of America effluents.

Thorium^{230} results obtained on samples of Animas River water during the year 1961 are negligible as compared to the MPC levels. Near background concentration were found both above the Durango mill as well as at the Colorado-New Mexico State Line. These values are in the order of 0.05 compared to 200, the MPC Guide Level. This low level is due to impounding our solvent extraction raffinate which contains large quantities of thorium^{230}.

Our data indicates to us that radioactive solids play an important part in river pollution and therefore must be kept from entering the river. Vanadium Corporation of America effluents contain negligible amounts of solids. We feel that during high water some of the radioactive solids from natural sources have an important bearing on the total radioactivity of the river. The silt load of the Animas River is small compared to that of the San Juan River into which it flows. We would like to see data on dissolved radium and on mud or silt samples from the San Juan River above the junction with the Animas.

We wish at this time to express our thanks to the various Government agencies for the cooperation received on this problem.

That is the end of my prepared speech. After listening to some of the statements and data here, I would like to make a few other remarks.

First, I was glad to see that the results, or some of the results given by the Public Health Service, confirm, more or less, our results on soluble radium. On the matter of solids, I am in perfect agreement. Our data shows that the solids are very important in ridding pollution from radioactivity. I agree perfectly with Dr. Tsivoglou. We have no data and do not take any data of any solids in any river, but we believe that if the soluble radium is down in the river, it is the best indicator you can have that there are practically no solids in the river.

As to the Animas River, at the present time we feel it is approaching background so that the solids are not a problem.

As to the biological effects, we have no one capable of that data, and we are glad that Mr. Henderson put in the record the information on the Animas River this morning. It sounds good.

I might add to that that the fishing is excellent above the mill site, and below the mill site, and at the mill site. We have our plant superincendent and our master mechanic living on the mill site. They go out and catch a fish or two quite often in the evening. Last August or September, a quarter of a mile from the Durango Bridge, they caught a German brown trout, which, according to the publicity, was the largest German brown trout ever caught in Colorado. It was 35 inches long and some 30 pounds.

I might mention that we have settling ponds, and seepage ponds, and evaporation ponds. Seepage and evaporation ponds are a misnomer. We have found that the seepage is practically nil. All of the loss of liquid in the ponds is loss from evaporation. Of course, in the winter, and when the humidity is high, we have no evaporation, so that we have to keep adding ponds all the time in order to keep up with our supply of that, but we have changed our process. We are still using part of the old process for probably another month or so, but we will eliminate this rapidly and eliminate the need for some of these ponds. We have not had any tailing pond incidents with the exception, I believe it was, of last August, when we lost a few gallons of liquor from one of these seepage-evaporation ponds, but it was in the nature of 2,000 gallons, and we have put over 100 million gallons in those seepage ponds.

I am interested in the work that they are going to do in having a cooperative program on tailing ponds, because that is a terrific problem. I wish them lots of luck and we will work with them.

Thank you.

THE CHAIRMAN: Thank you.

Are there any questions or comments?

I might say that this shows what can be done in the river. We sent our biological investigator down below the Animas mill back in 1957 and 1958, with the notion that he might look at the skeleton structures of some fish to see what was happening. When he got down there he found a biological desert for about 50 miles. He couldn't even find any mayflies or other clean-water organisms. This, in his opinion, was due to a solvent extraction raffinate. This was pointed out to the Vanadium Corporation. It was very expensive stuff that they didn't like to lose either. This was stopped almost immediately, and as you can see from the reports, the river has come back. This is always an imponderable. You never know, when something is wiped out, how long it will take the river to come back.

As I understand it, after the first spring freshet, after that time, and it was a big one, evidently, the river was scoured and the improvement was very, very dramatic.

I am glad that they are catching big trout there. It is just a problem now of stocking it.

Thank you.

THE CHAIRMAN: At this point Mr. Gahr would just like to introduce a few representatives of Colorado industry. Then we will call on the other representatives of the uranium industry after that.

MR. GAHR: At this time I would like to introduce other representatives of Colorado industry who are present here.

The first, representing the Colorado Fuel and Iron Corporation, is Mr. Harold H. Christy. I would appreciate it if he would stand, and if he has any comment to make we would be glad to have him do so. I for one would like to see him.

Mr. J. L. Boyce of the American Gilsonite Company, I believe, is in the audience. Is Mr. Boyce present? He expressed the intention, or it was understood he might be here. Probably he has grown tired. I understand he was here this morning.

Colorado, of course, has to share people with other states, and we have a representative here from the Kerr McGee Nuclear Fuels. I believe that is Mr. Bryce N. Logan.

Mr. Logan, do you have anything to say at this time?

MR. LOGAN: Mr. Chairman, Conferees and Guests. My name is Bryce Logan. I am with Kermac Nuclear Fuels Corporation, as Mr. Gahr said.

Kermac appreciates the opportunity of having a representative here at this meeting. Kermac now operates one mill on the San Juan River at

Shiprock, New Mexico. This operation has received some comment both last year and this year because of the dam break that occurred at that installation in late 1960. Since that time the dam has been reconstructed and a second dam has been provided which has an additional insurance against reoccurrence of that particular incident.

In addition to that, some of the old tailings area has been used as a mine for vanadium, to be reprocessed through the mill, and this provided additional pond space. The Shiprock operation sampled upstream and downstream. They have one point upstream and several points downstream and they sampled several seeps. All of the seeps that come into the San Juan River. Initially the deposits were assayed on a monthly basis. Recently the deposit has been spread out over a quarterly period, with quarterly assays made on all of these samples.

According to the assays we have received from these composite samples, all results have been below MPC for Radium-226 and thorium.

In addition to the mill at Shiprock, New Mexico, Kermac did until fairly recently operate a uranium mill at Gunnison, Colorado, on the Gunnison River. The shutdown of that mill started about two weeks ago, and at this time I believe it has been completely shut down. They have gone through it and cleaned out all of the circuits and tanks.

That is all I have to say. Thank you.

THE CHAIRMAN: Are there any comments or questions?

MR. GAHR: I don't believe we have any other representatives of Colorado.

THE CHAIRMAN: At this point, as you people may have known, following our legislation, the Congress recently changed the authority for this and invested the authority for the program directly in the Secretary of Health, Education, and Welfare. In order to administer the program, the Secretary designated an Assistant Secretary to be in charge of the program, and, of course, as you might guess, this Assistant Secretary is my boss. He has just come into the room to meet with you, and I would like to introduce now the Assistant Secretary of Health, Education, and Welfare, James M. Quigley.

THE CHAIRMAN: Now may we have Mr. Travis Redman? He is with Texas-Zinc at Grand Junction, Colorado. The plant is at Mexican Hat.

Mr. Redman.

MR. REDMAN: My name is Travis Redman. I represent Texas-Zinc Minerals Corporation. I do not have a prepared statement.

We operate a uranium processing plant at Mexican Hat on the San Juan River at the Navajo Reservation. Mr. Thatcher was kind enough to invite us to make a brief statement and we looked forward to doing this for two reasons: One is it made it possible to hear people like Dr. Tsivoglou and other authorities, whom we normally in our field do not get a chance to listen to. Secondly, we would like to let you all know by our presence here that we are more than casually interested in the problem.

I cannot think of anything spectacular about our operation. We have been plugging along since 1957, I guess it was. We have made several changes which involve, I think, almost all of the phases of radioactivity which we are required to take care of and report to the Atomic Energy Commission.

We have a salt extraction plant. Our only effluent is a very clear raffinate. We do not discharge any of our sand tails or any of our liquid tails to the river but we make use of them and get a little better recovery of them. We recently cleaned up a couple of streams by a filter and backwash, and things of this nature, which in addition to containing radium-226, also contained a little uranium. I am glad to get that fact in the pot.

I'm afraid that's it.

THE CHAIRMAN: Are there any comments or questions? If not, thank you very much, Mr. Redman.

May we call on Mr. Ted Izzo of the Uranium Reduction Company of Moab, Utah, I understand, with mills in Logan, New Mexico.

MR. IZZO: My name is T. F. Izzo. I work for the Uranium Reduction Company. We operate a uranium reduction mill at Moab, Utah.

First, I want to thank Mr. Thatcher for the opportunity to be here today and to make some remarks. As we discussed at the last meeting, the Uranium Reduction Company has probably the most ambitious river survey of any single mill. We have been making this survey since 1959. Since the last meeting we have continued this survey on a somewhat smaller basis, although we are still monitoring on what we think is a more than adequate basis.

For instance, we are continuing to monitor the Green River, even though we have nothing at all to do with its watershed. The survey includes thorium-30, radium-226, and uranium in the river, and the effluent, as well as twelve chemical constituents in the effluent. These samples are composited monthly and assayed. Some of the improvements that we have made in radiological controls since the start include a process change in 1959 with regard to leaching. This dramatically reduced the levels of radio-nuclides in that way. We are the single largest contributor to the reduction of it. We added a secondary settlement pond to which the overflow from the primary pond flows.

Also at the same time we changed the point from which we were drawing on the first pond to the periphery, and this improved the clarity of the second pond, and, of course, the second pond further improves the clarity of the overflow.

Since the last session we made some other small improvements. We found our secondary pond dike was endangered to some extent from the outside by a dry wash when it would run wet. Since the last session we have rip-rapped this dam with rock in order to protect it not from material going through the pond, but from water running from the dry wash outside of it.

Also, we have increased the size of our main or primary pond by some 15 feet, and probably have the largest pond in the plateau now--about 50 acres. We found it rather effective for a large settling area, and rather effective for singling out solids. Recently we started recycling about a third of the pond overflow process which means if you put in a third less in the river, it's a third less you have to worry about, I guess.

That's all I have at this time.

THE CHAIRMAN: Thank you, Mr. Izzo.

Are there any questions or comments? Thank you very much.

I would like to take this opportunity to thank the representatives of industry for coming. I think we have here one of the best demonstrations of cooperation between industry, the States and the Federal people, in dealing with a problem. I think this cooperation and the way you have thought through your pollution control problems, with the remedial facilities you have put in, has evidenced itself in a really dramatic and spectacular fashion on the river. Radiation levels here have been markedly reduced, which has affected the whole Basin.

I think this really is a record that you gentlemen can be proud of.

Now we have a choice which I would like to offer to the Conferees. The time now is 5:25 o'clock by my watch. We can have the States' statements made tonight, or have them made in the morning, with the discussion then. How would you prefer it?

Mr. Thatcher makes a good point. He ways some of his invitees have left, and he suspects they might be back in the morning.

I think if we adhere to the schedule, do you think we could have the States' statements and the discussion, and still adjourn in time for the dedication? Is this agreeable? Perhaps if we start at nine that will give us an opportunity to finish in time. Will that be all right?

Anyone who has left, if he can get word to them, we will inform them that we will start promptly at nine tomorrow morning.

Mr. Thatcher called our attention to the fact that he may have some industrial representatives here who will not be able to be back tomorrow. If there are any such in the audience, perhaps you can identify yourself for Mr. Thatcher, and you will be given an opportunity to make your presentation now. Also, anyone from New Mexico?

If not, we will stand in recess until nine o'clock tomorrow. Thank you.

(Whereupon, at 5:25 o'clock p.m., the Conference recessed until 9:00 o'clock a.m. the following day, Thursday, May 10, 1962.)

THE CHAIRMAN: May we reconvene? Mr. Nasi?

MR. NASI: I would like to make an announcement at this time concerning the dedication.

As indicated or expressed yesterday, all are cordially invited to attend the dedication, which will be a dedication of the Project Laboratory at 1750 South Redwood Road, approximately three miles south and west from this location in Salt Lake City. The dedication will take place at 2:00 p.m. We will have a short ceremony lasting perhaps three-quarters of an hour, and then the laboratory will be opened for visitation. There will be exhibits demonstrating the various activities in the laboratories within the Project Laboratory.

We will have transportation available for those who may not have it.

At 12:45 and 1:30 p.m., at the central entrance of the Hotel Utah, the bus will be departing for the laboratory. That is at 12:45, a quarter to one, and at 1:30. Similarly, return trips from the laboratory will be available by the same busses at 3:30 and 4:15 p.m. The bus will be a large one which will accommodate, I think, all who wish to use it. We cordially invite you to come to the dedication.

Thank you, Mr. Chairman.

THE CHAIRMAN: We will continue now with the reports and statements by the various States.

First we would like to call on Mr. Williamson of Wyoming. Mr. Williamson.

MR. WILLIAMSON: I take it that these reports are in regard to uranium, particularly?

THE CHAIRMAN: Or any other statement you may wish to make.

MR. WILLIAMSON: Insofar as the uranium industry in Wyoming is concerned, we have it all over in the Missouri Basin, so we do not have to worry about the discharges getting into the Green River. We have five operating mills, all of them on the Missouri River drainage, so we are not involved in that problem. We only have about one municipal problem, which we hope will be solved in this construction season this summer.

So, we feel that the Green River will be in pretty good shape for turning it over to the States lower down. As far as the pollution of the Green-Colorado goes, I think that would form my statement on it.

There is one comment I would like to make after hearing yesterday's discussion. The one that bothers me a little bit maybe is the matter of dikes that came up here, for the construction of ponds. I am sure we can work this out with the Atomic Energy Commission and everyone can come to an agreeable answer on it, but the question is, is this necessary. I have observed dike failures in other fields, and it seems to be not particularly something that is confined to the uranium industry, but is found in all industry. It is a problem of industry. I have seen dikes fail in sugar refineries. We have a lot of trouble with them in the oil fields, and I have seen them fail in diamond mines and other places. It is a problem of industry and, when you get to looking at it, you find the basic problem is that nobody has done any engineering.

We have gone through this matter of failing dikes, particularly in the oil industry, and we have found that an earthen structure is probably the simplest thing, and the most exact science we have in the construction of dams. Otherwise we would not be building Garrison Dam and a lot of the other large dams on the Missouri River. It is no secret that you can build an earth dam to stop or hold anything you want to behind it, but somebody has to design it in order to accomplish that effectively. We solved it with the oil and gas people by passing the word along to the organization that since they did not have competent engineering personnel to design these dikes, the next time one failed we were going to require every mud bath location to have a set of plans drawn up by a competent consulting engineer, and have them submit it for review and approval prior to the time they drilled an oil well. And, surprisingly, we have not had a failure since then. It cleared it up real well. Instead of telling a bulldozer operator to go out and make a pond, because you can bet it's going to fail every time, I would say to industry, make sure you have an engineer back there to design these dikes and you won't have this problem at all.

THE CHAIRMAN: Thank you, Mr. Williamson.

As I understand it -- and if I do not state it correctly on this problem I hope the Atomic Energy Commission will correct me -- one of the keys in working up criteria on these dikes would be to get plans and specifications set into some authority; and hopefully, I don't want to prejudge what the criteria will be, but the criteria and the plans for this would be made by a competent engineering group with standards of American engineering. I think this is the key to the problem with the dikes. For industry, in a sense, I think this may be the most economical manner of dealing with dikes in the long run because, as Mr. Williamson pointed out, where industries are plagued with dike problems, sometimes the regulatory agencies come up with much more expensive solutions.

The oil industry's leaks, at least through much of the south and southwestern part of the country, have not demonstrated very definitively that they can put up dikes which will hold. What most of them are having to do now is to go to reinjection, that is, taking the oil collected with a collection system and reinjecting it into the ground. This has developed over the years because the States and we patiently went along with these dikes and had dike failure after dike failure after dike failure in many of these areas. Again I would say, I am with Mr. Williamson. I was one of the persons who was ready to give industry the chance to see if these dikes could work, because theoretically there is no reason why an earthen dike should not hold the material. I think that is what the Atomic Energy Commission and the States are working for.

I think the answer to this is that when you have a relatively new industry, if sound engineering judgment can go into the construction of a dike, your earthen walls will hold up. If that is the pattern of the industry, then this would probably be the best way to do it.

Mr. Nussbaumer, did you want to say anything about this?

MR. NUSSBAUMER: Only, of course, that we are looking at the design and construction of these earth dam systems in connection with licensing. We feel, to the extent we can, we should express as criteria those factors we take into account, so everyone knows what factors we are looking at; and these factors, we feel, should assure that there will be a minimum of dike ruptures from improper construction.

THE CHAIRMAN: I know you said that, but here is the key point. We have had this situation, for example, when we give a grant for the States with regard to a sewage treatment plant, whether it is in a lagoon or a conventional treatmentplant. Before the design is approved by the State it must be submitted by a recognized competent engineer. This person must have gone over that, and then the State will check that against the criteria.

I do not know what your thinking is on this, that is, whether one of the requirements you are going to have -- and I think it was Mr. Williamson's point -- whether one of the requirements you were going to have is that this be developed by someone with engineering competence. In other words, not just that the criteria be set forth and maybe they will use it and maybe you will review that, but before the specific plans come in, this is developed by an engineer who puts his name down on it and stakes his professional reputation on it that he has looked at the criteria, and in his judgment this structure meets the criteria you have set forth.

MR. NUSSBAUMER: I think in practice it will work this way. I am not prepared at this time to say we will require necessarily a professional engineering firm, for example, will have to design these dikes, but I think the information submitted will speak for itself in that regard, because if the information that was submitted was not in accordance with the criteria, or with sound engineering principles, our engineering staff, which evaluates these things, will obviously notice it.

THE CHAIRMAN: This thing needs some more discussion. Do we have any comment or questions on this?

MR. BONDERSON: I am not clear about this in my mind, but I would like to ask, can the Atomic Energy Commission review these plans for dikes prior to construction?

MR. NUSSBAUMER: Yes, sir.

MR. BONDERSON: They can review and approve it for industry?

MR. NUSSBAUMER: Yes.

MR. BONDERSON: Thank you.

MR. MARX: Do you require that the plan be submitted to the State?

MR. NUSSBAUMER: We can require that they be submitted to the State.

MR. MARX: Yes, before any construction, that the State pass on the plans. We require it in Arizona, and I was just wondering if the Atomic Energy Commission could specify that these plans must be approved by the responsible State agencies.

MR. NUSSBAUMER: Well, we could coordinate it. I am not prepared to say whether we can require it or not. I don't know. I would be happy to look into it.

MR. MARX: We are quite concerned about these ponds. We know what happened in Shiprock. We do not know what the long-range effect of that disaster is going to be. We are quite concerned because Lake Powell is very close to these mill operations, and it is going to have a long-range effect. These things should have some assurance to insure that this type of thing is not going to occur periodically. We heard yesterday that there was a slide and a loss of something like 2,000 gallons. It could have been the whole damned thing, as far as that is concerned, and we're quite concerned about this.

MR. NUSSBAUMER: I don't see why we couldn't coordinate the evaluation of these plans with the States.

MR. MARX: We have had a lot of experience in ponds. We could take a lot of these mining companies, for instance. As an example, take Phelps-Dodge and some of these other big companies. They have dikes and they don't waste a drop of water. They use it over and over and over again and don't let one drop of water get away.

THE CHAIRMAN: I think we have identified what the area is that we are going to have to discuss and work out. I don't know that we can arrive at any conclusion here, but I think that some of the uranium industry people may want to speak to this.

MR. REDMAN: Yes. Travis Redman of Texas-Zinc.

I want to make a point to be sure the record is straight, that these dams are already built, and we are not talking about new construction, I hope. It does have a bearing upon the question.

THE CHAIRMAN: I think that is the thing that the Atomic Energy Commission will no doubt take into consideration when these criteria are developed.

MR. MARX: We are in the same position we were a number of years ago when we got on this problem. The thing was already built and the States were not aware of what was going on, and here we are trying to get the situation cleaned up.

THE CHAIRMAN: That is right. I do not think we are going to overlook this. This is a situation that we face.

I may make two observations based on our experience. I think we have a very, very large staff going over plans and specifications for sewage treatment works and for their approval.

By the way, the staff in the Federal Water Pollution Control Program is about 900 now. I do not think that that would be sufficient. I think we would have to have a staff four times as large, and I'm not sure we could manage it then, if the plans and specifications would come in and the sole engineering responsibility was ours to evaluate these plans. That is, if we did not rely on sound, professional engineering judgment made by professional engineers before the plans were put in, and if we were not getting preliminary reviews of these plans by the State agencies, so that they have been over them once. I say that because it is a tremendous job in any kind of a regulatory agency, or in a bureaucracy, to get plans in and try, in a detailed, engineering way, to be responsible to make the initial review of those plans without any engineering judgment and experience coming in in between.

Then again I think George Marx makes this other point. We have two problems in this business. One problem is new construction and what we do with new construction. The other thing is dealing with the situation as we find it. We have two very different kinds of operations. Some of you may come from these larger or older cities. In those cases we have a delightful part of our business involved with what they call a combined sewer, which has both stormwater and domestic sewage going through the same pipes. Whenever it rains we get this spewing out, and this does not work too well in many cities. As a matter of fact, someone here said yesterday that if we have as much water as they had in the Missouri, we would not have a pollution problem here. But you know, St. Louis is right at the confluence of the Missouri and the Mississippi Rivers, and you cannot imagine a city having more water flowing by it, but they manage to pollute. They worked at it for a hundred years, but they managed it. What happened is, we came there and we found these conditions existing, as George says, and this is a problem you have to meet.

In developing these criteria this may break this problem down and we may have two problems, that is, the existing dikes you have and what is to be done with them, and the new construction, if any, and what is to be done with that.

Are there any further comments or questions?

MR. NASI: Mr. Chairman, I would just like to back up what Mr. Marx has stated concerning the States' interest in the approval of plans relating to water pollution in their respective jurisdictions. As you have expressed previously, and as has been reiterated on numerous occasions, it is the basic declaration of the Federal Water Pollution Control Act that the Congress recognizes, and preserves and protects, the primary responsibilities and rights of the States in preventing and controlling water pollution.

In this connection we, in the construction grants program of the Public Health Service, believe it is a part of the program that the States do approve all municipal sewage treatment facilities in the States, and this is a very effective procedure, as you have already pointed out.

THE CHAIRMAN: Are there any other comments or questions?

MR. GAHR: I'm sorry to have to prolong this matter.

MR. CHAIRMAN: Go ahead.

MR. GAHR: I do feel that there is a lot of fog up here as to what we are really talking about. I get the impression we are just talking about tailings ponds. If that is the case, that is a part of the mining operation, and since these people are responsible people, like municipalities and others, I would think they could be trusted with the construction of a facility that is going to be reasonably safe, and, in the event of its failure, they are still responsible.

I would like to point out that impoundments in most of these States, as I understand it, have plans that are passed upon by the State engineer's office as to the type of construction and the safety of it. I don't deny for one minute, and I recognize, that we will have the necessity for investigating this very thoroughly. I certainly appreciate your concern. We have this too, and our inquiries are pretty darn sharp where there are little towns below that. So I would agree with the Conferees that we look into it carefully for the reason that there are so many ramifications. The State engineers and the Federal Government and many other agencies are involved in this, and it necessarily takes looking into very carefully.

That is all I have to say.

THE CHAIRMAN: Yes. All right. Now that you have raised that point, I think procedurally we have to have this kind of treatment. I don't think in dealing with that that our Department would have any regulatory effect on the ponds in any industry. This would be a matter for State judgment and State regulation. However, we have heard the statement of the Atomic Energy Commission on the way that their law operates--and they have the jurisdiction--and the Atomic Energy Commission are contemplating putting out regulations, or a statement in the Federal Register on it. I do not know where this would go. We are cooperating in this with the Atomic Energy Commission and with the States. So if there is to be any Federal criteria, any enforceable criteria, enforceable by a Federal agency for the design factor, it would be that of the Atomic Energy Commission and not us.

MR. GAHR: And it would be applied only to the industries.

MR. MARX: But in this thing they should recognize that the States have a responsibility here, and we would like to know when these things are going to happen so that we can get in on a preliminary phase of it in order to develop an adequate system. In doing that the States would share in the responsibility for it. That is one thought that should be expressed.

When we approve plans we share in the responsibility of the operation of it.

THE CHAIRMAN: Thank you, gentlemen.

Do we have any other comments? If not, can we call on Mr. Thatcher.

MR. THATCHER: We have no formal report to present, Mr. Chairman. I would again like to express our appreciation to the United States Public Health Service that they are conducting this, which obviously could not have been done within State resources; and certainly the interstate aspects have to be handled by the Public Health Service. We have expressed our views before on the importance of considering the whole range of water pollution problems. I think it is well to stress this again in view of the discussion we have just had on dikes. We cannot limit the question to accidental releases of contaminants through breaks in dikes to the uranium industry. We will have many industries where ponding might be involved, where this could happen.

Again I would like to stress the point that we have made before. We are considering all contaminants and not just one special confined group. We would like to continue with the privilege, as one of the conferees, of discussing at various times with the Public Health Service experts the different problems that come to our attention, and have them give consideration to modifications in their techniques or plans. We have had this privilege so far and have no reason to expect that we won't continue to have it. I think it is a very important part of this program.

We have had some concern on this question of salinity because the Colorado River at times at Yuma has a known salinity beyond the limits specified for drinking water. Of course, this is one of the important uses we must consider on the Colorado River. I would like to suggest that in the future the Public Health Service might give a little more extensive study to what was referred to yesterday as natural sources of salinity, with the object of determining whether or not these could be controlled. The same applies, of course, to any other sources in existence now, or that we might anticipate developing from any cause.

Is it in order, Mr. Chairman, for me to call on some invitees now?

THE CHAIRMAN: Yes. I would like to have one point of clarification. This is just clarification.

What do you mean by, in a sense, natural sources?

MR. THATCHER: I was using it--

THE CHAIRMAN: Let us be specific. Do you include irrigation return flows as a natural source or not?

MR. THATCHER: I don't know that I can define that. It was referred to in the papers yesterday, and I assume what referred to yesterday as natural salinity did not include irrigation sources. In other words, this might not be a natural salinity. It might be man-made.

THE CHAIRMAN: A man-made one.

MR. THATCHER: Yes.

I would like to recognize some of our other State agencies now.

First, Mr. Francis T. Mayo, who is in charge of Water Resources Operations for the State Engineer. Do you have a statement, Mr. Mayo?

MR. MAYO: The State Engineer's office does not have a formal statement to make. However, I think at least two observations might be made about some of the business that transpired here yesterday.

One would be with respect to the announcement that in the very near future there will be an attempt to apply logic to the development of criteria for water quality standards for all, if I remember correctly, legitimate water uses in the Colorado River system. It is going to be interesting to see the extent to which the application of logic with regard to water quality is or is not going to be compatible with the history of the development of the acquisition of water rights in the Colorado River system.

One other thing I would like to mention. A comment was made yesterday which went by perhaps without some emphasis as to its possible significance. This was part of Mr. Rodner's statement, and I would like to quote it just by way of observation:

> "The Bureau of Reclamation, representing the Secretary of the Interior, is the custodian of the Colorado River."

MR. THATCHER: Thank you, Mr. Mayo.

Next I would like to recognize Mr. Norman Chamberlain of the Utah Fish and Game Department.

MR. CHAMBERLAIN: Thank you, Lynn. Mr. Chairman, Conferees and Ladies and Gentlemen.

There are two major points I would like to bring out here today. Each has a direct bearing on pollution as it affects fish and wildlife resources within drainages of the Colorado River originating both within Utah and in two of our neighboring States. The first deals with pollution problems that the Utah Fish and Game Department has encountered in past years, as well as those of a more current nature. The second is concerned with a potentially serious consequence of radioactive pollution in Powell Lake soon to be created by the Glenn Canyon Dam.

I would like, briefly, to point out several of the past and present problems my Department has encountered on the Colorado River drainage of Utah.

During a three-year period from 1949 through 1951, large quantities of waste crank case oil were discharged to the Green River from a group of railroad yards at Green River, Wyoming. The results were damaging to fish and wildlife throughout sections of the Green River in both Utah and Wyoming.

A substantial nesting population of Canada Geese was virtually eliminated as well as other waterfowl; fish kills were extensive, and damage to fur-bearing animals was also widespread. This problem has since been greatly reduced largely through the efforts of the Wyoming Department of Game and Fish working with the company involved.

Another problem of oil pollution originates at the Rangely Oil Fields in Rangely, Colorado. Waste oils periodically gain access to the White River nearby and flow then into the Green River in Utah. This problem is sporadic in nature and usually occurs during high runoff periods of spring and early summer.

Waste oils also enter the Green River from an oil refinery located at Jensen, Utah. This source, although again sporadic in the nature of its discharge, is also a regular contributor to this type of pollution.

From time to time reports reach us of oil pollution on the San Juan River from a large oil and gas development located in the Four Corners Area. Data on this source is fragmentary; however, it is probable that periodic pollution occurs here also.

In 1953 part of Scofield Reservoir and three of its drainages--these are all tributaries to the Colorado--in Carbon County were so grossly damaged by drilling muds, drilling compounds and oils resulting from explorations for natural gas, that all fish life as well as bottom fauna was eliminated. Extensive damages due to silting of stream beds was also noted, resulting from these activities. In this case the company involved assumed their responsibility and agreed to replace the fishery loss. Again in 1961, drilling activities in this area caused a pollution problem and it became necessary to remind the company of its responsibility.

The second point which I previously mentioned is concerned with the possibility of Powell Lake becoming badly polluted with radioactive substances resulting from effluents discharged by a substantial number of uranium mills scattered throughout the Colorado Plateau region.

If my sources of information are correct, there will be not less than nine uranium mills which will contribute their waste effluents to Powell Lake when its creation is begun next spring after completion of the Glenn Canyon Project. These mills are all located on drainages of the Colorado River system in Utah, Colorado and New Mexico. Presumably all of these mills produce similar byproducts in their operation. Radium, thorium and a host of other radio nuclides are contained in these effluents. Some these have a half-life longevity of many thousands of years and are known to be concentrated by certain aquatic organisms hundreds of thousands of times that of the environmental concentrations. It appears that a strong probability exists here that radio nuclides previously carried in suspension by the river would now be deposited in the silts of the lake and therefore made more freely available to aquatic organisms and the food web.

I presume the U. S. Public Health Service has considered this possibility. Assuming this is the case, I would like to ask if present plans for survey work on the river include this aspect and if they do, would these investigations be carried out on a more or less continuous basis in order to determine any chronic long-term effects?

In conclusion, I would like to state that the Utah Department of Fish and Game is concerned with pollution problems which may result from any source within the Upper Colorado River drainage. This is especially true of those areas which might influence the fishery or wildlife resources of the Flaming Gorge and Glenn Canyon Dams. We have a number of important mineral resources which are more or less characteristic of the Colorado River drainage. These include petroleum, natural gas, uranium, potash, phosphate, gilsonite, and others. All of these are well represented in Utah and future planning indicates that development and expansion of these resources will proceed at an accelerated rate. This will in turn require additional reuse of the available water in this arid region, and consequently, increasingly more stringent controls to insure an adequate quality as well as quantity of water supplies at all times.

Thank you.

THE CHAIRMAN: Thank you very much. If you wish, we could call on Dr. Tsivoglou to answer your question.

Dr. Tsivoglou, did you hear the questions presented by Mr. Chamberlain?

DR. TSIVOGLOU: Yes. I'm not sure I remember them all, but I think we showed yesterday that the evidence we have gathered in our sediment surveys now over a year and a half indicates we have no major present problem such as you are concerned about. I appreciate very much your concern for the future. It does seem, though, that the industry has largely controlled, through their own efforts and everybody else's, the discharge of suspended spent ore solids and, as nearly as our survey showed, there is very little of that now getting into the river.

Also, as we have mentioned, last year we checked the sedimentation in Lake Mead, which is one of the great reservoirs of the Basin, and we did find as nearly as that data indicates, there has been a slight increase in the radium content of the sedimentation. However, it is slight and in the neighborhood of perhaps doubling background, and this we cannot regard as serious at this time either. So it looks as though this particular problem is under control by the industry.

Now, in respect to another question, the answer is, yes, we intend to continue surveillance of this kind of thing.

I don't remember any of the other questions.

THE CHAIRMAN: No. Those are the questions. I might say, sir, when this problem came up, we had the same concern that you do. One of the big concerns was that assuming that the mills put in the remedial facilities, which has been done, what happened to the streambeds and how long did this last. Well, we are happily surprised at the results.

Evidently there have been very, very minor accretions of radioactive material. In one of the streams that we studied pretty carefully because of a case down there, the Animas River, we waited until after the first spring freshet. The water came down and it was largely cleaned up after that.

The next problem we have is, well, if it begins washing out of these little streams, where is it? We tried to trace it down and went down to Lake Mead, of course, and the same investigators found very, very little increase in Lake Mead. So evidently, using this technique, very little damage has been done. But we are going to look at it and we appreciate your question, because this is precisely the same problem we had, and the results show up very well.

MR. CHAMBERLAIN: Thank you, Mr. Chairman.

MR. MARX: I would like to point out one thing. Even though the concentration may be low in the stream, we know that vegetation takes up radium very readily, and it has a tendency to concentrate in vegetative life, so that over a period of time, and I don't know whether studies were made on this or not, but as to fish feeding vegetation in our lakes, and so forth, wherever they are in the Basin, or where this type of pollution is, we do not know what will be the ultimate result.

THE CHAIRMAN: You can ask only that. I think we certainly did think of that problem.

Dr. Tsivoglou, do you recall that point? That was precisely the point we had when we went to the Animas Mill and got the biologist up there to check the fish.

Dr. Tsivoglou, have we looked into that?

DR. TSIVOGLOU: I can comment a little bit. There is a question of concentration of radioactivity in fish in particular?

THE CHAIRMAN: Concentrations in the bottom being taken up in the plants, in the biota.

DR. TSIVOGLOU: Yes. We have in the past looked into this to some degree and we do have some results. They amount to this: We have found

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radium concentrated in algae and in bottom insects by factors of 100, and in a few cases 1,000 times. We did follow up two or three years ago with a very small number of fish samples, particularly bottom feeders, suckers in particular. We found this: It was quite revealing. We have all been referring to radium as a bone-seeker, and, since it was supposed to be a bone-seeker, we separated fish into flesh and bones and analyzed them separately. We found some very interesting results and they amounted to this: Bones had concentrated radium by a factor of about 100 times, but the flesh had concentrated it only by a factor of two or three times.

As I said, this was a very limited number of animals that were tested, and the results statistically are not adequate, but I think they reveal very clearly what is happening. Radium truly is a bone-seeker and does not go very much to the flesh of fish.

Does that answer your question?

MR. MARX: That answers the question, but the only thing is, I think in talking about pollution, any kind of pollution, that we should try to keep and get as close to zero as possible and practicable and not say, well, we will set a limit of one micromicrocurie, or some other figure. I think we should get it down and eliminate it as much as possible from a practical standpoint.

DR. TSIVOGLOU: Yes, sir. I hope I made my own views on this clear yesterday. I think in all seriousness that the industry also recognizes the problem and is attempting to go towards it.

MR. MARX: Thank you.

THE CHAIRMAN: Mr. Williamson.

MR. WILLIAMSON: I might clarify the first point brought up on the Green River. The original oil pollution on that water is due to the very large train yards at the Green River of the Union Pacific Railroad, which were at one time discharging an awful lot of oily waste, plus a lot of other things. I think it was in 1957-1958 that the Union Pacific Railroad constructed a treatment plant for all their yard wastes, which has been operating very well since that time, and we have been quite happy with it. There has been, to my knowledge, one spill of major importance during that time which was due to a lack of duplicate pumps. Since then they have put in bigger and better duplicate pumps and have not had any major spills I know of, and I hope it corrects the situation.

THE CHAIRMAN: Mr. Thatcher.

MR. THATCHER: I am not aware of any others of our invitees who specifically wanted to make a statement. So let me take a minute to ask if there are any others from Utah who would like to make a statement at this time? That would include industry, or State government, or local government. They are perfectly at liberty to do so, if they care to make a statement.

Apparently not, Mr. Chairman.

THE CHAIRMAN: Thank you. Mr. Caldwell.

MR. CALDWELL: First I want to point out how pleased we are in New Mexico at the Animas River and emphasize what Mr. Stein said yesterday. It shows what industry and government can do with a pollution problem. The people, as they go along the river, are much happier than they were with the abatement that had been promulgated there.

Also I want to point out that the continuing survey is continuing.

The completion of Navajo Dam, Shiprock, and the Hammond Projects may cause changes in the river flow, and undoubtedly will. I think it behooves all of us in the Public Health Service and the Bureau of Reclamation and the States to work together to keep these problems at a minimum.

Also it is true that the San Juan Chama diversion will also, when it goes through, bring about changes. These projects will bring about economic changes in the communities, and undoubtedly there will be population growth. For example, we may find that sewage may cuase trouble downstream. So, we will all have to keep our eyes on the problems.

We hope Mr. Gahr will take steps to insure that all his dikes are in order.

When you talked about radioactivity I thought that you might be interested in what our three major towns on the Animas are doing. They are Farmington and Bloomfield and Aztec on the river there. Farmington has increased its sewage treatment plant capacity in the last year from a total of 25,000 to where they could handle a load of 50,000. At present they have only 26,000 connected, so there is plenty of surplus capacity. They have increased their water treatment plant to handle a capacity of 38,000 up from the original design capacity of 25,000.

Bloomfield's sewage treatment plant was constructed to handle a load of 2,500 people and includes a clarifier, filter, and several ponds there.

The water treatment plant at Bloomfield has been enlarged to about one-third of a million cubic pound per day capacity.

The Aztec sewage plant is now designed for about 9,000 capacity, and only has about 4,500 people connected. They have also increased the capacity of their water treatment plant.

I thought I would tell the Conferees, as well as the members of the audience who might be interested in this, because we are working very hard to prevent pollution from municipal sewage and waste.

I am wondering if there is anybody else here from New Mexico who would like to say anything. If not, thank you, Mr. Stein.

THE CHAIRMAN: Thank you, Mr. Caldwell.

Are there any comments or questions?

Again I think it is pretty indicative of what happens on the river system when you get a clean-up in progress and get both municipal and industrial clean-ups on the river. I think it makes a very good record for New Mexico.

MR. CALDWELL: Thank you.

THE CHAIRMAN: Mr. Marx, do you want to make a statement now?

MR. MARX: Yes. Is it my turn?

First I would like to commend the Public Health Service, the Atomic Energy Commission and the mill operators for the progress made in the last year. We were happy to participate in some of the studies made on the Colorado River in the boundaries of Arizona.

There is one thing we did -- and I hate to belabor this saline situation -- but a tour of inspection was made of the Wellton-Mohawk irrigation area with New Mexico engineers, which involved some Federal agencies from the United States as well. We have been receiving the results of the four basic sampling stations on the Colorado River and had an opportunity to review those and keep in touch with what was happening as far as water quality on the Colorado is concerned. We have made some investigations on animal feed pens which may involve pollution on the California side, but so far has not resulted in a problem on this side. However, we do plan to keep in touch with the water pollution authority of California to study some of these local situations that may occur from time to time.

I did mention our concern about the holding ponds and the fact that Lake Powell will be the catch basin for all kinds of pollution which might occur in the Upper Basin. I also want to emphasize the fact that this is going to be one of the greatest recreational areas in the country. The Park Service has plans for all kinds of recreational facilities on Lake Powell when Lake Powell becomes a fact. So that is a situation to keep in mind.

We do have one problem which has given us a lot of trouble at Nogales. In fact, I would like to state that Arizona had the only two international sewage plants in the country. The one at Douglas drains to the south and drains into Mexico. The one at Nogales drains north. The drainage from Mexico -- Nogales-Sonora and Nogales, Arizona, is to the north and goes into the Santa Cruz River, which empties into the Gila River, which in turn empties into the Colorado. The plant has been overloaded for a period of years. It has been a rather difficult situation because you have two governments that have to get together on planning and expanding this plant. We have a population in Nogales-Sonora of approximately 40,000, as against 8,000 on the United States side. They have had to halt their program of complete sewage collection on the Mexican side because the plant can't hold it. The International Boundary and Water Commission has been quite static in this situation, although the plant has been overloaded for about three years. Nothing has occurred.

We have pounded away at this and used our congressional representatives, etc., etc., trying to get the situation cleared up. The point is that the plant is so overloaded that when it does go through and when it is not bypassed, the sewage is inadequately treated. It creates a potential health hazard to our stream with water supply. We hope to get this cleared up.

There has been a change of administration in the International Boundary and Water Commission, and we hope that they will get on the ball and will get something done.

As far as our future program is concerned, we are planning now to sample and analyze all of our waters in the State of Arizona for radioactive nuclides. We plan to continue participation in the study and survey and sampling analysis, and so forth, with the Public Health Service team on the Colorado River Project, and any other Federal agencies that might be interested.

We plan to continue our research project with the University of Arizona, in which we are trying to find out what the survival of pathogenic micro-organisms is in oxidation ponds or stabilization ponds.

We have added one thing to this project in which we are trying to utilize high frequency sound waves to take suspended solids out of liquids, particularly water. It seems to look like it is going to work pretty well.

We are also in this next year or so planning to get all of our people in Arizona -- all the agencies, Federal and State -- interested in water resources -- together to plan some research projects.

I think that is about the size of it, Mr. Chairman.

THE CHAIRMAN: Thank you.

Are there any comments or questions? If not, we will call on Mr. Bonderson.

MR. BONDERSON: Mr. Chairman and Conferees, Ladies and Gentlemen. I have no prepared statement to present. I trust my comments of yesterday made quite clear my views on the conduct of the Project.

I should like to thank Mr. Brinker and Mr. Beverly for their presentations of yesterday. The information they submitted was most enlightening as it relates to California's interest in this uranium milling situation. It is very enlightening, and I would like to thank them for presenting this information.

I presume that the Chairman will make some comments relative to the wishes of the State in the summarization of this Conference.

THE CHAIRMAN: Yes.

MR. BONDERSON: That is all I have to say then.

I would like to introduce two Californians who are here. First, a representative of the Colorado River Board of California, W. Don Maughan.

MR. MAUGHAN: I have nothing to add. Thank you.

MR. BONDERSON: And Mr. Arthur J. Inerfield, represeting the Department of Water Resources of California.

MR. INERFIELD: I don't have anything to add.

MR. MARX: Mr. Chairman, I forgot to ask if there were any Arizonans here who would like to be recognized. I know yesterday Mr. Klagge was here representing the Arizona Legislature. He is the Director of the Arizona Legislative Council and has been assigned to water pollution problems by the Legislature. He was here yesterday. I don't think he is here today.

THE CHAIRMAN: Thank you. Mr. Gahr?

MR. GAHR: Mr. Chairman, Colorado has a prepared statement which I would like to read at this time.

This statement depicts Colorado's position relating to the Public Health Service water pollution study being conducted on the Colorado River System. It briefly reports events occurring within the State, as well as an analysis of the results now available from the Project study. Additionally, it will contain remarks and requests to be offered as guidance for future conduct of the Project. The statement reflects the thinking contained in communications from individuals, industry, and that of several State officials comprising the Colorado Interstate Agencies Ad Hoc Committee on Water Pollution.

Several events have occurred in Colorado during the last year which have an effect upon that portion of the Colorado River drainage system lying within the State.

There has been planning, construction, and improved operation of waste treatment facilities. New primary and secondary sewage treatment plants were placed in operation at Dillon and Montrose. Sewage lagoons constructed at Palisade replace a primary treatment facility. Planning for such facilities has been initiated at Delta, Meeker, Craig, and Steamboat Springs. Action has been instigated to bring about the planning for sewage treatment facilities at Telluride. Additional investigation has been conducted into discharges of industry wastes from an acid plant on the Dolores River. The uranium milling industry has continued to make improvements and to exercise careful surveillance of wastes discharged.

Water storage projects on the Upper Basin of the Colorado River System have been receiving continued study. Additional information relative to water quality concerning these projects has been requested of the State Health Department. Particularly pressing is information for a report to the Colorado Water Conservation Board. This report requires water quality information for proposed projects in the Gunnison and Ridgway areas. It is due in one year or less. Other storage projects are under study, and the same need for water quality information exists in these instances.

A useful publication Public Water Supplies of Colorado, 1959-60 was issued during the summer of last year. This publication was produced through the combined efforts of Colorado State University, U. S. Geological Survey (Ground Water Branch) and the Colorado State Department of Public Health, plus other contributors. It pertains to the quality of water supplied the public from Colorado municipal systems.

Research into water quality problems has received attention. The State Health Department is involved in a research project involving surface waters (formerly cistern water project) which is aimed at determining the amount of radioactivity to be found in such waters presumably resulting from fall-out. The engineering group of the State Health Department is also working with the University of Colorado in an effort to secure a grant for basic research into potato starch protein waste water degradation. The Office of Saline Water is operating a field test for demineralization of ground water; this particular field test site, employing electrodialysis, is located on the Delpra farm near Loveland, Colorado. Studies and investigative research have continued to make progress in the State during the past year.

Work commenced on the construction of a portion of the Colorado River Storage Project. It was mentioned to you yesterday. This particular project, Blue Mesa Dam, will provide multiple use of water; it is located downstream of Gunnison on the Gunnison River, and commonly known as the Curecanti Unit.

Members of the Colorado Interstate Agencies Ad Hoc Committee on Water Pollution during the past year have considered information supplied by the Colorado River Basin Study Project. Monthly reports from the Project indicate that most of the time was devoted to assembling a staff and preparing for the work ahead.

You have also heard about the amount of investigative data that has been developed there in accordance with some of our objectives. The amount of significant data obtained was somewhat limited; as a consequence, the Colorado State Health Department did not attempt to extract this material from the monthly statements to send to interested members of industry.

Three special subject reports were issued by the Project, of which two were of particular interest to Colorado. They are:

(a) Stream Surveys in Vicinity of Uranium Mills.
    I. Area of Grand Junction, Colorado - August 1960
    II. Area of Moab, Utah - August 1960.

(b) A Study of Colorado River Water Quality near Yuma, Arizona - June 1961.

(c) A Preliminary Investigation of Radioactivity in Crops and Soils on Selected Farms - October 1961 -- which is very interesting, and we understand it will continue.

These reports were made available to interested persons.

As the Colorado Conferee, I would like to submit the following for consideration as guidance items for the Project during the next year's operation:

1. Provide for the early release on a regular basis of all significant raw data collected on that portion of the Colorado River Basin within the State of Colorado.

It is recognized that the Project Officer will determine what data ought to be released. However, in the exercise of his judgment it should be noted that even small amounts of data can indicate a trend, a trend sufficiently significant to require early action insofar as abatement is concerned. This was discussed last year.

2. Institute intensive investigative work into determining how much radioactivity found in surface waters is the result of natural situations.

There are indications that considerable radioactivity (radium) may be leaching out of the sediments and entering surface waters in this manner. Obviously, there is great need to determine that quantity of radioactivity resulting from milling operations and that occurring as a result of natural situations. This information is necessary if satisfactory abatement is to be accomplished. Establishing the level of natural radioactivity seems to be a valid argument for intensive investigation in this area.

3. Review objectives established June 8, 1960, and those added at later dates for the purpose of redefining where necessary both objectives and related priorities.

Such a review is desirable considering the changing needs for information this Project can supply to others, i.e., for Colorado River Storage Projects.

4. Distribute to Conferees at least six weeks prior to Conference those technical papers that are to be presented at Conference

The reason for this is, we will save a lot of time. I am sure in my case we will feel a lot more able to ask questions. Then additionally, in Colorado we have this Interstate Agency Committee, and these people we depend upon very greatly. We need this information in order to tell their representative at this Conference their views, which is fundamentally our reason for asking that we receive the information earlier.

We do get the reports which are made available to the committee, but anything to come before the Conference we would like to have six weeks in advance, if possible.

Technical papers presented at a Conference could be more valuable to the Conferees if they have the opportunity to study and review them with other interested persons in their own States.

5. The State of Colorado desires assistance on the following:

Last year we asked for the study of the oxygen content on the upper reaches of the Colorado River and the headwaters up above Rifle. I don't know that that was done.

Then we are also interested, and I think this question was already answered, Mr. Chairman -- in view of the backlog of samples in the laboratory, I guess we would not have a chance or an opportunity to send the laboratory any unusual type of water samples, although we would like to have this permission.

THE CHAIRMAN: You can check. I would not say that that is a fact. I would explore that. Of course, I do not want to speak for Mr. Rushing, but this is the purpose of the laboratory. Obviously it is a service to work with and serve the States. I don't think we have any unusual situations in this laboratory that we do not face with all laboratories. They are just staffed up now and they have their backlog. Once they get operating and the production line gets moving, these things clear up very, very fast. I remember when we had the same situation in a tremendous six or seven-story laboratory in Cincinnati. You could not walk through the halls because of the samples that were stored there. These things happen. I haven't seen any new laboratory without it.

The States met last night, I believe, and the States have a couple of requests or suggestions, and, speaking for myself, I think they are very good.

One suggestion is that we do not make a formal summary of the Conference here; but we can summarize, or I think I can try to summarize what the representatives have said. Then we will mail a draft of the summary out to the States for the States' comment. Based on those comments, the summary will be prepared and a final summary will be sent out and the States will make the summary available to all who wish it.

I think the second suggestion made is a very excellent one. I was not at the meeting last night, but I could not agree with it more. This is the thought, that all of the Conferees, State and Federal, review the objectives of the Colorado River Project and review it carefully to see where we are going, and to see how we have met these objectives. They will do this within three to six months and come up with an evaluation of these objectives. I think the Project got off very rapidly, and in some areas they have done a considerable amount of work, while in others we haven't.

We have some major objectives that we outlined at the First Session, and I don't know whether we are continuing them.

I think for the purpose of the record, to help the States, we may go over some of these fourteen points in a moment, and we would like a response from either you, Mr. Sponagle, or Dr. Tsivoglou, not as to answering the questions, but as to whether we have done the work on some of that and provided the answers for that on which we will give them a summary, or whether we haven't been able to. I think we should outline the reason why we haven't been able to get at the problem so we will have a more realistic appraisal of the objectives that the States will be able to think of in terms of these objectives.

As I see this, unless we know where we are going and the Conferees set up the objectives, and the Conferees know how close your investigating group is coming to providing the material necessary to make determinations for meeting these objectives, we really are not proceeding in the most orderly fashion.

I think Mr. Brinker may have something to say.

MR. BRINKER: On the dike matter I would just like to offer a few remarks that have come up time and time again here. I believe in the mining and milling industry at least in Colorado over the last forty years, our experience has been good. I believe that there is perhaps a little over-emphasis on the tailings ponds matter.

The next thing that concerns me particularly is the responsibility of the company for these dikes. I believe that if the results are to be maximum results, the company still has to have the responsibility, or the company has to have the power to act, and to act quickly. I do not believe myself that adding a consulting engineer's report, or some names to it, would help in that. It would hurt, I believe, if it takes the responsibility away from the company. If something happens to a company's tailings pile the company is responsible, and I do not believe you want to take that responsibility away from it.

As to the Atomic Energy Commission, I am also hopeful that in their planning they do not take this Monticello tailings pond incident, which in my opinion is of minor importance, and let that enter into their planning for these tailings ponds. Everyone in the industry, I am sure, is very concerned about the ponds, and they have the responsibility. They have to put this in them or put that in them, and change them, and if we are to be responsible you can't take that away from us and still get the results.

THE CHAIRMAN: Thank you. We appreciate your views, Mr. Brinker.

As far as I am concerned, not only here, but in any other pollution problem, I sure won't take away the responsibility from industry. They are responsible for any pollution. I think your remarks are well taken, but I wonder if we could go ahead on this. It might be quite a revealing session. I won't call on you for this first list, but I just want to call out the fourteen points, and I want the Conferees to recollect what we decided at the first Conference.

We decided that we are going to look into domestic and municipal wastes. I don't know to what extent we have done that.

Secondly, wastes resulting from the harvesting and processing of the timber resources of the region. This is a summary.

Next, wastes from coal and oil shale deposit developments. Also industrial wastes, including wastes from food processing and similar industries. The deterioration of water quality by agricultural uses, including fertilizers and insecticides, and erosion.

Also we are going to look into pollution caused by other toxic and chemical materials and pollution caused by radioactive wastes.

Again I just put that out for background, and I would like to go down this list of fourteen points and perhaps you people can answer this and, to save time, maybe I can answer them.

1. Compliance with criteria developed for construction, maintenance, and operation of uranium mill waste control facilities on a mill-by-mill basis.

I think the report covered that.

The system utilized for alerting State and Federal agencies of any spills and how it is operating. I think that was covered.

Now we come to No. 2. The location and extent of discharges of uranium mill and any other industrial wastes containing toxic non-radioactive chemicals which are damaging to aquatic biota and status of remedial action.

I think the report covered that. I don't know how adequate it was on the status of remedial action.

3. Extent of hazards from radioactive contamination of crops in the Upper Basin attributable to radioactive contamination of irrigation waters, and status of remedial action.

Would you be able to tell us that?

MR. SPONAGLE: I thought I covered it yesterday reasonably well. I did point out we have not been able to get all of the samples analyzed and, therefore, we intended to continue as far as that was called for.

THE CHAIRMAN: Right.

Now, as to this phase of getting the samples analyzed, would that be corrected when the laboratory goes into operation?

MR. SPONAGLE: I think that has already begun to be corrected.

THE CHAIRMAN: No. 4, extent of hazards from radioactive contamination of the dry washes at Maybell, Colorado, and Mexican Hat, Utah, and of South Creek, near Monticello, Utah, and the status of remedial action.

Have we covered all three of those in the report? We covered all three of those in the report.

5. The status of solution of water supply problem at Yuma, Arizona.

That has been covered.

6. Proposed methods for evaluating long-range effects of radioactive content of Basin deposits.

Do you want to comment on that?

DR. TSIVOGLOU: My comment is to this effect: I am not certain myself precisely what this means. We had considered the sediments -- we continued the sediment surveys and that has been completed, as we had hoped they might. As to the three surveys for the hydrologic cycle, we intend to continue those somewhat further. I imagine at this point it relates to those surveys and therefore I think we are proceeding with that point.

THE CHAIRMAN: I think this is what we are putting out to clarify this. If this objective is not clear, either it should be dropped, or changed, or clarified. That is the reason why we are going through this. Because unless we get our objectives lined up on where we are going, we don't know how progressive we are.

The next one is, pollution attributable to recreational boating use of Basin lakes.

Is that covered?

MR. SPONAGLE: Only to a very minor extent, as Mr. Henderson indicated yesterday, in the Parker area. No significant pollution was found.

THE CHAIRMAN: We recognize it was not covered. Can you give us an indication why it was not covered and what the thinking is?

MR. SPONAGLE: Yes. I think my comments here could apply to the rest of the items which you have not covered yet. I think these fourteen items have represented a pretty heavy workload, and we have tried to concentrate our efforts and complete as many of these as possible. At the time of our last Conference, as you know, our staff was not complete and we did not have a full staff. Our full staff came on duty in September of this past year. Since that time, and, of course, in the interim, we did try to accomplish as much as possible, but it just has not been possible for us to complete all of these items.

THE CHAIRMAN: All right. The point is, I think you might indicate for the purpose of the Conferees if they are going to review these objectives, if you feel you can do these next year. Because if we have an objective and it is not realistic, I think we have to know that.

Do you intend to get at this recreational boating or not?

MR. SPONAGLE: Yes. I think with the items we got out of the way this year, that will be possible.

THE CHAIRMAN: You intend to get to all of these items then? Let us go down them. You intend to get to recreational boating?

MR. SPONAGLE: Yes.

MR. MARX: Mr. Chairman, I might mention that the Public Health Service liaison officer, through the National Park Service, is working on this problem.

THE CHAIRMAN: All right.

MR. MARX: They are sending up Charley Wright there. You know him?

MR. SPONAGLE: Oh, yes.

MR. MARX: They are working on this very thing -- recreation.

THE CHAIRMAN: Yes.

MR. SPONAGLE: There are other activities within the Public Health Service with whom we will coordinate.

THE CHAIRMAN: We will coordinate this and certainly not duplicate the effort.

How about the effects of pollution on oxygen levels in Basin waters?

MR. SPONAGLE: We have done a little work on this this year, particularly in the Animas Basin, and I think in one other place. We didn't get into the Rifle area, but we do have a series of surveys we are discussing for next year.

THE CHAIRMAN: But you are planning to do it next year?

MR. SPONAGLE: Yes.

THE CHAIRMAN: The next point, and I don't know what happened on this, is the status of study on nitrate concentrations in underground waters in the Shiprock, New Mexico, area.

MR. SPONAGLE: We didn't get into it. We have made some observations. Our geologist came with us in 1962, and has made some preliminary observations. We hope to be able to get into it.

THE CHAIRMAN: You expect to do that this year?

MR. SPONAGLE: Yes.

THE CHAIRMAN: The progress report on the development of long-term water quality management program for the entire Basin. Do you think you have covered that?

MR. SPONAGLE: We have covered the progress we have made.

THE CHAIRMAN: Okay. Again I don't know that we have done this, and maybe it is an aspect we should look into -- have we implemented this report from industries participating in the Conference of their activities in improving water quality?

MR. SPONAGLE: It was my understanding that these reports obtained from the industries was what was desired in this connection.

MR. BONDERSON: Mr. Chairman, just an observation on your comment on the progress report. You may have made a progress report, but it didn't indicate to me what you were doing. I don't understand what you are doing.

MR. SPONAGLE: Well, I think we have perhaps clarified that with the Conferees.

THE CHAIRMAN: We will cover that in the summary. I think he made the point that not much progress has been made, but he gave a progress report on the development of these criteria, as to what progress they had made.

The next point is the quality of water in Lake Mead and its suitability for use as domestic water supply.

MR. SPONAGLE: We have not gotten into that this year.

THE CHAIRMAN: Will you be able to get into that?

MR. SPONAGLE: Yes.

THE CHAIRMAN: I know it is a problem, and will continue to be a problem in the Las Vegas area. No one from Nevada is here except for Mr. Rodner, and maybe he will speak for them. But this is a problem. The operational status of radioactivity water monitoring network is the next item.

You have covered that.

The last one is the dilution requirements in the Animas and San Juan Rivers to protect water quality downstream.

This has not been gone into.

MR. SPONAGLE: This we are currently working on. It is a part of the study we have made in the Animas-San Juan area. We will have a report on this particular item in our report on this subject.

THE CHAIRMAN: Okay.

Now, I think if we look at the magnitude of the task, that the batting average is not too bad.

MR. MARX: It's pretty good.

THE CHAIRMAN: Mr. Sponagle, you have covered quite a few of them.

MR. NASI: With respect to No. 10, the progress report on development of long-term water quality management program for the entire Basin, the comment was made by one of the State Conferees indicating he did not understand it, or did not understand the report on progress. I arise in defense of the report.

The report was made yesterday. I know that the report was not given out in advance, unfortunately. It will be a part of the transcript, and I think if the State Conferee who made the statement would read that report, he will in fact get a report on the progress in this particular matter.

THE CHAIRMAN: I am going to summarize that in a minute and I will give you what they said. Let me go off the record here.

(Discussion off the record.)

MR. MARX: I wonder if Mr. Gahr would enlarge on his request that raw data be submitted to him.

MR. GAHR: Yes. I think that this goes back to the Las Vegas conference. We felt, or our opinion or view at that time was, that the Project would be moving ahead. It has started, and I think all of us are overambitious or we underestimate the length of time it takes to get started. We always do this. It is another engineering lag in judgment. Anyway, at that time we did have agreement that we would accumulate this data, and as rapidly as raw data became available it would be put in the progress report, and that the States would then extract the portions from that report that had an interest to the people in their States and attempt to mail it to those folks. Well, actually the way it turned out last year we didn't really have much, and in our view we didn't think we had information that should have been or would have been of so much benefit that it was worth extracting, so we didn't do it.

Now, I am sure with the way that the Project is staffed and ready to go, and having had this experience, that we are going to get a lot of data, and it is probably going to be somewhat of a task for each State to extract it and send it out. If that is the case we will have to accept that.

MR. MARX: I wonder how big a problem it will be for not only the Public Health Service, but for the States? How soon do you want this raw data? As soon as the analytical data comes out of the laboratory, or when? And what can you do with it? You will have an accumulation of data.

MR. BONDERSON: Mr. Chairman.

THE CHAIRMAN: Mr. Bonderson.

MR. BONDERSON: I think we are quite unrealistic in our request of last year. You are going to be processing a tremendous volume of data, and you just can't run any efficient operation and try to get this out on a quarterly basis. The material that was submitted to the States Tuesday was very helpful and very enlightening. It was good and, it would be, I think, very desirable from our point of view if something comparable to this could be done maybe twice a year. Maybe it would be done once just before the Conference and once half-way in between.

However, to ask for something more than that, I think, is very unrealistic.

MR. MARX: I think it is very unrealistic, Bill.

MR. GAHR: I don't think it is unrealistic at all. I think that it depends on the Project people here. They will be running on to data and information that they think in their judgment has immediate value.

For example, there may be something they discover that they would think would be worthwhile presenting nine or ten months in advance of this Conference. It is an annual affair, but if they find information that would be useful to municipalities or industries, I think it should be made available.

MR. MARX: That is fine. That is fine. If they find such information or such a situation they should report it to the States. That is all right, but not the whole cumulative thing.

THE CHAIRMAN: We are in substantial agreement. You mean if they have a special report which would be useful they should not wait for any formal reporting system, but get this material out?

MR. MARX: As an example, Murray, this salinity situation was recognized in Yuma before Mexico even thought about it. You see what I mean. Our basic data station in Yuma picked it up right away, and we had the information.

MR. GAHR: We are both in agreement, only we don't realize it.

THE CHAIRMAN: That's right. I think this will be worked out, which brings me to the first point. I think on the summary, in outlining what we have done in setting up this project, we tried to avoid Parkinson's law as much as possible and delegated this project to the field. In Denver we gave them a maximum amount of autonomy, and in Salt Lake City.

The first point is what I just asked you people to bear in mind, namely, that the one way that a central bureaucracy can load down working guys is by imposing a reporting responsibility on them where they have to keep occupied preparing staff reports for some people whose sole duty in life it is to review staff reports upstairs, or send them out to a mailing list of States or other people who throw them into the waste paper basket, or file them.

MR. MARX: We are getting tons of paper work.

THE CHAIRMAN: It is what we are trying to avoid by setting up these people in their own buildings, with their own staff, and hoping we will get them in a position where they can do productive work without having all of this superstructure of the bureaucracy on top of them all the time.

As to the staffing here -- and at least this is a summary of what they have said, which was presented yesterday -- the staffing of the field project has been essentially completed. Out of the originally planned total personnel complement of 43 for the entire project, 22 are presently on duty at project headquarters in Denver, and 19 in the project headquarters in Salt Lake City, Utah. Presumably it is what we budgeted for and staffed for. We know what the resources are and have set the objectives for the work patterns, and we will see what is produced. We have completed the laboratory construction in an existing Federally-owned building that will be dedicated this afternoon. Full-scale laboratory operations have recently been inaugurated. This has been done.

We have made several studies, or the field staff made several studies in the past year. They have come up with certain conclusions and findings. They found that a level of one micromicrocurie per liter or less of dissolved radium-226 has been attained in the waters of the basin with only two exceptions. This high level of protection demonstrates the feasibility of minimizing total radiation exposure as called for by the most recent radiation protection standards document. It assures us total radiation exposure from the mixture present in the waters of the basin should remain at safe levels. A radium monitoring network is in effect. We have to maintain continuting surveillance of the radium content of river waters. As I understand it, this network will be expanded next year to the full proposed complement.

The two exceptions to the level of one micromicrocurie per liter are in Montezuma Creek below Monticello, Utah, and the San Miguel-Dolores River System below Uravan, Colorado. Considerable effort is being made by the

Atomic Energy Commission in the first case, and by Union Carbide Nuclear Company at Uravan, to improve these situations.

The recent sediment surveys have substantiated a Ra-226 level of 1.3 μμc/g of sediment, with a relatively narrow range. Based on this level the surveys have indicated that the residual contamination of the basin streams by uranium waste solids is now very small. Seventeen sampling stations of the radium monitoring network are in operation and, as indicated previously, additional stations will be installed during the next year. Samples collected in this manner have been analyzed for Ra-226. Preliminary indications point to a relationship between radium content of top-soils and crops like alfalfa and grasses establishing relatively high radium levels.

Bottom animal studies in the Animas River below the Vanadium Corporation of America's uranium mill at Durango, Colorado has shown large numbers of clean-water organisms in all sections and indicate the river in this area has returned to normal biological conditions. Levels of dissolved radium in the Animas River waters at the Colorado-New Mexico line have been found to be below one micromicrocurie per liter.

Bottom animal studies on the San Miguel River above the Union Carbide Nuclear Company at Uravan, Colorado, showed large numbers of clean-water organisms. Below the mill there was a drastic reduction in all organisms, a condition which continued all the way to the mouth of the Dolores River. This reduction was attributed primarily to the chemical toxicity of waste discharge by the Uravan mill as demonstrated by several toxicity tests carried out on these effluents. The most highly toxic uranium mill wastes are found in lagoons at Durango and Rifle, Colorado, Shiprock, New Mexico, and Mexican Hat, Utah. Accidental releases of lagoon contents by these mills would drastically affect receiving waters. It is imperative that these lagoons--and, by the way, these are all recommendations of the investigating staff--it is imperative that these lagoons holding these effluents be constructed so that possibility of such accidental releases be minimized.

Suggested criteria for construction and maintenance of earth dam retention systems and a means of alerting appropriate Federal and State agencies in the event of dike failure have been prepared and are being prepared by the Public Health Service and the Atomic Energy Commission. Both agencies will get together within the next sixty days and hopefully, develop a mutual position on these items which will be reviewed and commented on by appropriate people.

A reconnaissance study made in the Parker, Arizona, area, indicated no serious problem with respect to dissolved levels of bacteria or chemical pollution.

A reconnaissance study in the Yuma area indicated no serious problem with respect to the BOD level--the levels of dissolved oxygen. The discharge of raw sewage from Yuma caused a substantial increase in coliform counts. This comes as no surprise. Silt from the All-American Canal desilting basin is a major detriment to the recreational use of the Colorado

River between Imperial and Morelos Dam and greatly decreased the productivity of the river in this area. Return flows from the Wellton-Mohawk Irrigation Distirct have been most significant factor in the deterioration of the chemical water quality of the Colorado River at Yuma, Arizona. The City of Yuma has temporarily made arrangements to serve the city public water supply by obtaining water from the Yuma Main Canal, that is, in the irrigation district. But as I understand the situation, it is very much a temporary situation, and the irrigation district is --

MR. MARX: Two years.

THE CHAIRMAN: Two years. They are not very happy about it, but allowing them to tap the canal for their water supply. A permanent solution will have to be found somewhere.

Now here is what was said, Mr. Bonderson. Considerable work was done in implementing development of a comprehensive plan for long-range water quality management. This includes (a) completion of first computer analysis of chemical water quality data.

(b) Development of basic demographic data in connection with initiation of an economic base study for the basin.

(c) Substantial completion of inventory of municipal and industrial wateruses and waste discharges. And

(d) Planning of field studies in the upper mainstem, Green River and sub-basins to provide basic study for comprehensive planning development.

If you entertain any hopes, I might say that this last is the kind of language I ran into in the last twenty years in engineering meetings, and it does not surprise me in the least.

MR. BONDERSON: Thank you, Mr. Chairman, for this predigested, simplified statement. I can partially understand it except for that big word towards the end, which I don't recall.

I would like to make one comment on your summary, though.

You do make the observation that water quality is being drastically affected from the silt.

THE CHAIRMAN: Let me put this to you: What I read was the investigator's summary.

MR. BONDERSON: Yes.

THE CHAIRMAN: I was just summarizing what was said yesterday. I do not want this to be construed as something that I have said, or that any of the conferees have drawn a conclusion on. If we have any questions on this -- and that is why I want to bring it up -- we should get the investigator who made this and discuss it and let him answer it.

MR. BONDERSON: This is not questioning, but it is to clear a point. This could be true, that there could be a drastic effect on water quality. This I don't know. But I would like to make the observation that to have pollution you have to have not only water quality degradation, but you have to have damage to the beneficial use, and I don't want to leave the impression just because there is maybe an effect on water quality that it necessarily means there is pollution.

THE CHAIRMAN: That is correct. Of course, let me make this clear for the record: You have statements on this, or at least it is understood in the West that beneficial use has a particular meaning within the term of "pollution."

Let me see if we can agree on this: As long as it interferes with a legitimate use, it is pollution. Do you agree with that?

MR. BONDERSON: I am tempted to ask what an illegitimate use is.

THE CHAIRMAN: There are uses of water which I think are not realistic. For example, if someone would make a demand, let us say, for swimming water quality at a place where there obviously could not be a beach or any swimming, you can answer that and say that this is really not a reasonable or a legitimate use of the river at that point, and you can say, "Go home and don't bother us."

MR. BONDERSON: The phrase we use is a recognizable beneficial use.

THE CHAIRMAN: Yes.

MR MARX: They have squatters along the Colorado River, and that might be termed an illegitimate use.

THE CHAIRMAN: That is right.

Does anyone want to comment, or make any further comments on this?

MR. LOGAN: I would like to make a statement for the record.

THE CHAIRMAN: All right. Will you identify yourself, please?

MR. LOGAN: My name is Bryce Logan, with Kermac Nuclear Fuels Corporation.

I am going back and referring to tailings and spillages. I feel compelled at this time to make some remark in view of all the allusions that have been made to tailings and dam failures. I have sort of gotten the feeling that perhaps some people feel that the uranium industry is not really seriously concerned about these accidental spills. As a representative of one of the members of the industry, I at this time want to emphasize that we are concerned and we view these things very seriously.

For instance, at Shiprock, as I mentioned before, the dam was reconstructed and it is compacted. A second diversion dam was erected. All the money that industry has spent in an effort to meet with compliance of all those various regulations, as well as the obligation they feel -- they feel morally compelled to do this -- would indicate we are really concerned about these things.

I just wanted to make that statement.

THE CHAIRMAN: Thank you very much.

Are there any comments on that? That statement is very well taken, and I think we made this point repeatedly. I think the industry has demonstrated an excellent public attitude and awareness of its responsibility.

MR. MARX: I think the reason we stress it so much is because of the nature of the health hazard involved in this thing. If you get radium into a stream, how are you going to get it out? There are other industrial wastes that can be taken care of, but this thing can't. If you get it into a lake or a stream you have 1,600-some-odd years to wait before the damned thing runs itself out. In the meantime it keeps accumulating. It's not just an accident, but a disaster, when one of these things breaks.

MR. BEVERLY: Mr. Chairman.

THE CHAIRMAN: Yes.

MR. BEVERLY: My name is Robert Beverly of Union Carbide. I would like to emphasize one point particularly of your summary statement regarding these lagoons which would have a drastic effect on the river, if there was a release.

THE CHAIRMAN: Yes.

MR. BEVERLY: In many cases the material in those lagoons is exactly the same material that is being released continuously to the river. The radium content may not be high.

THE CHAIRMAN: I don't think it was referred to. I think it was in the context of the toxic effects on fish life.

MR. BEVERLY: Right.

THE CHAIRMAN: I think that is what is meant. Not a radioactive hazard.

MR. BEVERLY: To back up a minute, as far as the drastic effect is concerned, it would all depend on the quantity involved. In some cases these lagoons are very small, and in some cases there are larger ones.

Going on to what we were just discussing about materials such as the radioactive material in these lagoons, as I say, a lot of times it is exactly the same concentration as what is being released. The purpose of the lagoon is to settle out any fine solids. So this material in the lagoon does not necessarily mean, nor do I think it usually means, that the radioactive concentration is any higher than is what is being released to the river.

In other words, we do not have a fund, or most uranium mills do not have a fund of high concentration here in the lagoons, and lower here. It is true in some cases, but in a lot of cases it is the same material.

The only other comment I might have on the summary is that sometimes figures are misconstrued. In the Uravan case, downstream, the summary did not mention the potential health hazard, as we look at it now, as far as the rating is concerned. I believe yesterday Dr. Tsivoglou pointed out there were waters elsewhere in the country that are much higher than this.

THE CHAIRMAN: I think that it is a good point.

MR. BEVERLY: Some people who do not understand these figures can construe it wrong.

THE CHAIRMAN: I would like to add that statement to the record, and if Dr. Tsivoglou disagrees, or if anyone disagrees with it, I would like to have them comment on it. At the present time the radiation concentrations in the Colorado River Basin due to uranium milling activities do not endanger health or welfare of persons in the Basin. I put that in terms of our statute because that is what we consider pollution, when it endangers health--and it is well below these figures. I think that should be clear.

Mr. Beverly raised the question on these lagoons. I do not know whether it is the biologist's field or your field, Dr. Tsivoglou, but on the point of highly toxic wastes in lagoons at Durango, Rifle and Shiprock and Mexican Hat, is this from a radiation standpoint or a toxic chemical standpoint? That is what I am getting at. Evidently our biologist who is in charge of these studies, thought that the non-radioactive toxic material in these particular lagoons would be highly detrimental to fish if there were a break in the lagoon, and it would wipe out a large portion of the river and you would have a biological desert. We have had experience with toxic spills. This is not necessarily a unique thing with the uranium industry. I think it is something we have all the time.

Are there any comments or questions?

Again, because some of you people were not in here yesterday, I do want to say that we do have the privilege of having with us today the Assistant Secretary of Health, Education, and Welfare, Mr. James M. Quigley, who has come here from Washington to participate in the dedication. We are very glad he has found the time to sit in and listen to this portion of the Conference.

Mr. Quigley, would you stand up for a moment?

THE CHAIRMAN: Mr. Nasi would like again to make that announcement about the dedication.

MR. NASI: I note we have a larger number of individuals here as compared with earlier in the day, when I did make the announcement. I would like to repeat it. Those who heard it before, please bear with me.

We will have two busses scheduled to depart from the Hotel Utah at 12:45, to go over to the site of the dedication at 1750 South Redwood Road, with another bus picking up at 1:30. Those times are 12:45 and 1:30 from the central entrance of the Hotel Utah. All those who may not have transportation may utilize this bus service. Return arrangements are similar. We will have a bus departing from 1750 South Redwood Road at 3:30 and again at 4:15. It takes approximately twenty minutes to go from one place to the other.

We cordially invite all to attend the dedication this afternoon at two o'clock at 1715 South Redwood Road, Salt Lake City.

THE CHAIRMAN: Does anyone want to make any point for the record or have any suggestion, or have anything to say at this point? Because I think we will be closing pretty soon, unless anyone has any further comment to make.

MR. MARX: I think you did a pretty good job.

THE CHAIRMAN: Thank you. I do not know whether you want to discuss this here, but we have discussed it previously with the conferees. In order to keep us on the straight and narrow we have to have these public conferences once a year. We have agreed to hold this once a year. To my mind there is nothing like one of these public meetings where everyone sees the way we are operating, so that they know what we are doing, and what you are doing. You in the industry particularly and the public are entitled to a report on our activities. I know we are a public agency and do the public business in a public manner. We do not have any secrets. We are in that very fortunate position. We recognize, while we are dealing with some people who are responsible for pollutants, in the last measure those people are really the taxpayers and the bosses, and pay our salary. You are entitled to know how we operate and what we do. We will have a meeting again next year and, of course, we wish you would all come to that meeting. I do not know -- it may be preliminary to discuss the area or the State that it will be in next year. Do you think it would be preliminary or do you think it should wait? Do you want to wait on that?

MR. BONDERSON: We like Salt Lake City and Denver is not in the basin. Although San Diego is a long, long ways away, it is essentially at the end of the pipeline. We would like for you to see and observe what the Colorado River has done for California. It has kept this beautiful waste alive. If it were not for the Colorado it would have reverted to a pueblo by now.

THE CHAIRMAN: If it were not for the Colorado, New York would still be the largest State. If I am wrong in this statement, you can correct me, but I believe ten million people in Southern California depend on the Colorado for their drinking water. Is that right? Ten million people in Southern California depend on the Colorado for their drinking water?

MR. BONDERSON: Somewhere between seven and ten million people use, fully or partially, Colorado River water to sustain their living.

THE CHAIRMAN: That is a more proper and accurate statement.

I think without acting for you on California, we are seriously considering that. Of course, as you well know, San Diego has other attractive attributes for holding the meeting. I wanted to give the conferees and other people the trend of our thinking on it. On the basis of past experience I can say that this is a beautiful time of the year to be in that part of the country too, although this was most pleasant. I think we have had some very excellent facilities made available here. The accommodations have been very, very good.

We would like to thank Mr. Thatcher and his staff for all the hospitality that has been shown us, and the wonderful cordiality we have received everywhere.

You have certain advantages here that people living outside of Utah are not familiar with. For example, the kinds of service you get in a hotel or restaurant around here has all but disappeared in most other parts of the country. You have lightning-fast elevator service, and the waitress service is just wonderful. Every once in a while we like to come here just to despoil it.

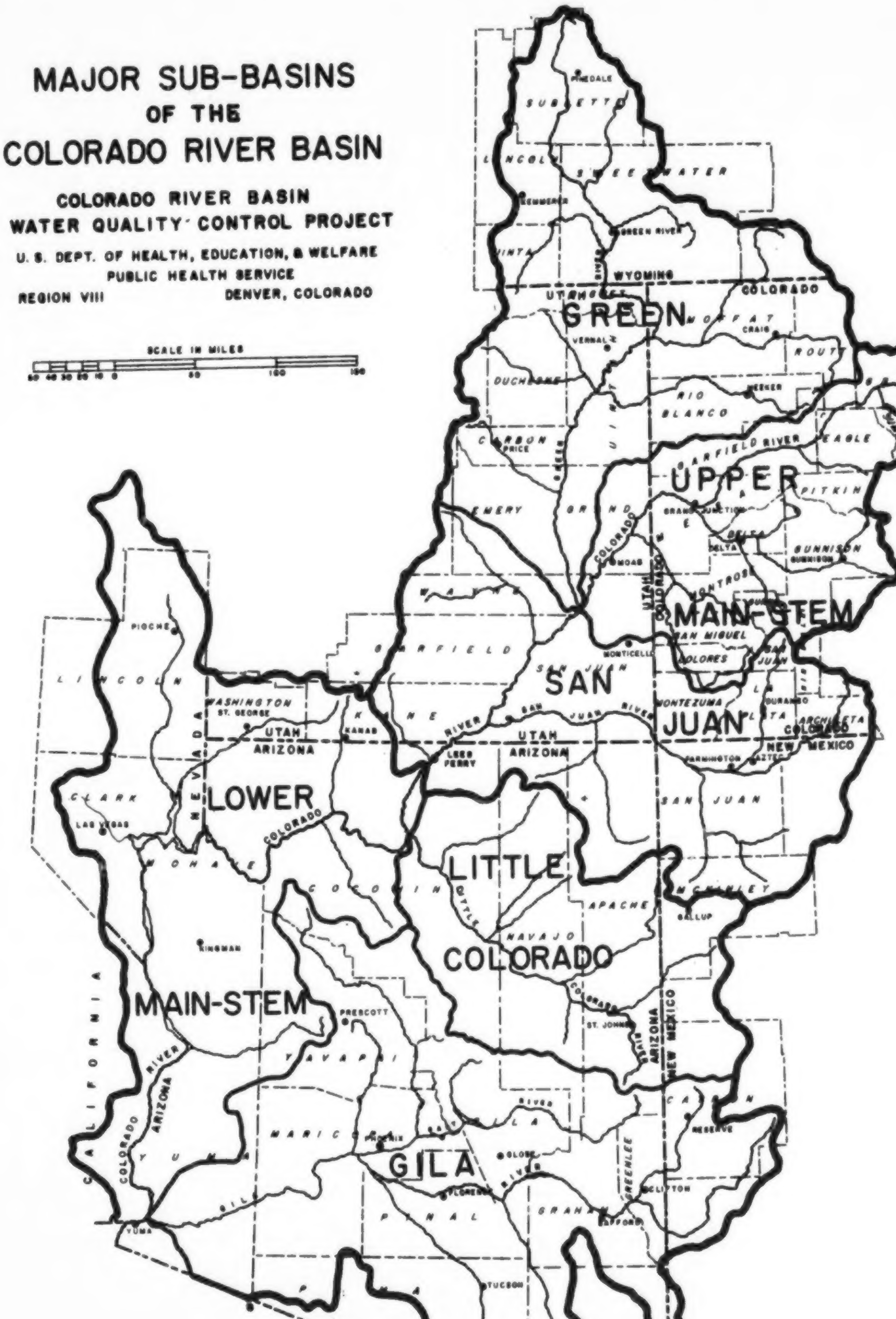
Are there any other comments or questions? If not, thank you very much for coming.

We stand adjourned until next year.

(Whereupon, at 11:15 a.m., the Conference was adjourned to a time and place to be set.)

MAJOR SUB-BASINS OF THE COLORADO RIVER BASIN

COLORADO RIVER BASIN
WATER QUALITY CONTROL PROJECT
U. S. DEPT. OF HEALTH, EDUCATION, & WELFARE
PUBLIC HEALTH SERVICE
REGION VIII DENVER, COLORADO


SCALE IN MILES
50 40 30 20 10 0 50 100 150
GREEN
UPPER
MAIN-STEM
SAN JUAN
LOWER
MAIN-STEM
LITTLE COLORADO
GILA
WYOMING
UTAH
COLORADO
ARIZONA
NEW MEXICO
NEVADA
CALIFORNIA
ARIZONA MEXICO
SUBLETTE
SWEETWATER
LINCOLN
UINTA
MOFFAT
ROUTT
RIO BLANCO
DUCHESNE
CARBON
EMERY
GRAND
GARFIELD
EAGLE
PITKIN
GUNNISON
MESA
DELTA
MONTROSE
SAN MIGUEL
DOLORES
SAN JUAN
MONTEZUMA
LA PLATA
ARCHULETA
WAYNE
KANE
WASHINGTON
CLARK
MOHAVE
COCONINO
NAVAJO
APACHE
MCKINLEY
YAVAPAI
MARICOPA
GILA
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GREENLEE
PINAL
PIMA
COCHISE
SANTA CRUZ
YUMA
CATRON
PINEDALE
KEMMERER
GREEN RIVER
VERNAL
CRAIG
MEEKER
PRICE
GRAND JUNCTION
MOAB
MONTICELLO
DURANGO
FARMINGTON
AZTEC
GALLUP
ST. JOHNS
PIOCHE
ST. GEORGE
KANAB
LEES FERRY
LAS VEGAS
KINGMAN
PRESCOTT
PHOENIX
GLOBE
FLORENCE
SAFFORD
CLIFTON
RESERVE
TUCSON
YUMA
COLORADO RIVER
SAN JUAN RIVER
GILA RIVER
LITTLE COLORADO

GPO 853014

APPENDIX B

UNITED STATES
ATOMIC ENERGY COMMISSION
WASHINGTON 25, D.C.

IN REPLY REFER TO:

JUN 4 1962

Gentlemen:

As you know the uranium mills typically employ earth dam retention systems to control release to unrestricted areas of wastes which contain concentrations of radioactive material in excess of those permitted to be released by 10 CFR Part 20.

In order to provide assurance that appropriate steps are taken by all concerned in the event of a rupture in an earth dam retention system and the resulting release of the contained waste to unrestricted areas, we believe that the public health and safety requires that your source material license be modified by adding the following condition:

> "The licensee shall immediately notify the Director, Region IV, Division of Compliance, USAEC, Denver, Colorado, by telephone and telegraph of any failure in an earth dam retention system which results in a release of radioactive material into unrestricted areas. This requirement is in addition to the requirements of 10 CFR 20."

Accordingly, pursuant to the Atomic Energy Act of 1954, as amended, and the regulations of the Commission, you are hereby notified that we intend to modify your license as indicated above. This notice is sent to you in order that, prior to the institution of formal proceedings for modification of the license, you may have an opportunity to comment on this change. If you are willing to have this condition added to your license without the issuance of a formal order, please so advise us within thirty days from the date of this notice. If we do not receive your consent, an appropriate order will be issued for the modification of your license by the Atomic Energy Commission, in which event you will be offered the opportunity of a formal public hearing in the matter.

Sincerely yours,

RL Kirk

Deputy Director
Division of Licensing and Regulation

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APPENDIX C

ATTENDANCE ROSTER

Conference on Pollution of the Interstate Waters
of the Colorado River and Its Tributaries

Third Session, May 9, and 10, 1962

Ted Arnow	Geological Survey, USDI Salt Lake City, Utah
N. K. Banks	Texas-Zinc Minerals Corporation Grand Junction, Colorado
James C. Bapis	United Press International Salt Lake City, Utah
C. J. Barber	U.S. Smelting, Refining, & Mining Co. Salt Lake City, Utah
Robert G. Beverly	Union Carbide Nuclear Company Grand Junction, Colorado
Hayse H. Black	Public Health Service Robert A. Taft Sanitary Engineering Center Cincinnati, Ohio
A. R. Blanch	Economic Research Service, USDA Salt Lake City, Utah
H. B. Blanton	California Oil Company, Western Division Salt Lake City, Utah
Paul R. Bonderson	California State Water Pollution Control Board Sacramento, California
Robert H. Bordner	Public Health Service Colorado River Project Laboratory Salt Lake City, Utah
Grant K. Borg	University of Utah and Utah Water Pollution Control Board Salt Lake City, Utah
Fred A. Brinker	Vanadium Corporation of America Durango, Colorado
Charles G. Caldwell	New Mexico Department of Public Health Santa Fe, Nex Mexico

N. V. Chamberlain	Utah State Fish and Game Department Salt Lake City, Utah
Harold H. Christy	The Colorado Fuel and Iron Corporation Pueblo, Colorado
Don A. Clark	Public Health Service Colorado River Project Laboratory Salt Lake City, Utah
Chester Cohen	Pan American Sanitary Bureau El Paso, Texas
Wayne D. Criddle	State Engineer's Office Salt Lake City, Utah
W. T. Davoren	Pacific Southwest Field Committee, USDI Salt Lake City, Utah
Frank E. DeMartini	Public Health Service Robert A. Taft Sanitary Engineering Center Cincinnati, Ohio
Robert J. Demint	Public Health Service Colorado River Project Laboratory Salt Lake City, Utah
John G. Detmer	U.S. Department of Health, Education, and Welfare Denver, Colorado
Paul W. Eastman	Public Health Service, Region IX San Francisco, California
Paul A. Fichter	Public Health Service Colorado River Project Laboratory Salt Lake City, Utah
Garry L. Fisk	Public Health Service Bureau of Reclamation Salt Lake City, Utah
J. W. Fitzpatrick	Public Health Service Denver, Colorado
Clarence J. Frost	Attorney General's Office Salt Lake City, Utah
William N. Gahr	Colorado State Department of Public Health Denver, Colorado

William J. Garcia	Public Health Service Colorado River Project Laboratory Salt Lake City, Utah
Lewis R. Garlick	Bureau of Sport Fisheries and Wildlife Albuquerque, New Mexico
D. R. George	U.S. Atomic Energy Commission Grand Junction, Colorado
Clyde D. Gessel	Bureau of Reclamation, USDI Salt Lake City, Utah
Robert W. Graham	Halliburton Company Denver, Colorado
H. N. Gullickson	Public Health Service Colorado River Project Laboratory Salt Lake City, Utah
William Don Hearn	Halliburton Company Vernal, Utah
Virgil T. Heath	Bureau of Land Management, USDI Salt Lake City, Utah
Croswell Henderson	Public Health Service Colorado River Project Laboratory Salt Lake City, Utah
John F. Hendrickson	Public Health Service Washington, D. C.
Charles R. Holland	Mountain Fuel Supply Company Salt Lake City, Utah
Howard M. Hurst	Utah State Department of Health Salt Lake City, Utah
Robert Hutchings	Public Health Service Washington, D. C.
Arthur J. Inerfield	California State Department of Water Resources Sacramento, California
Burdge Irelan	Geological Survey, USDI Yuma, Arizona
T. F. Izzo	Uranium Reduction Company Moab, Utah
S. K. Jackson	Geological Survey, USDI Denver, Colorado

Cecil B. Jacobson	U. S. Bureau of Reclamation Salt Lake City, Utah
Raymond K. Jarrell	Public Health Service Colorado River Project Laboratory Salt Lake City, Utah
Arthur H. Johnson	Public Health Service Albuquerque, New Mexico
Ariel M. Jorgensen	Utah State Soil Conservation Committee Salt Lake City, Utah
Elmo C. Julian	Public Health Service Colorado River Project Laboratory Salt Lake City, Utah
Hans Kiesler	Public Health Service Colorado River Project Laboratory Salt Lake City, Utah
G. R. Kilborn	American Gilsonite Company Salt Lake City, Utah
Jules M. Klagge	Arizona Legislative Council Phoenix, Arizona
Lester M. Klashman	Public Health Service, Region II New York, New York
Keith S. Krause	Public Health Service Washington, D. C.
Peter G. Kuh	Public Health Service Washington, D. C.
R. Hal Langford	Geological Survey, USDI Salt Lake City, Utah
Bryce N. Logan	Kermac Nuclear Fuels Corporation Grants, New Mexico
Robert P. Lowe	New Mexico Department of Public Health Santa Fe, New Mexico
George W. Marx	State Department of Health Phoenix, Arizona
W. Don Maughan	Colorado River Board of California Los Angeles, California
Bruce W. Maxwell	Public Health Service Rockville, Maryland

Francis T. Mayo	Utah State Engineer's Office Salt Lake City, Utah
Joseph McCoy	Corps of Engineers, USA Los Angeles, California
Joseph B. McKean	Coal Mines and Quarries Columbia-Geneva Steel Division Dragerson, Utah
Walter F. Megahan	Forest Service, USDA Ogden, Utah
Edward A. Moulder	Geological Survey, USDI Denver, Colorado
Kaarlo W. Nasi	Public Health Service, Region VIII Denver, Colorado
Donald A. Nussbaumer	U. S. Atomic Energy Commission Washington, D. C.
Herbert R. Pahren	Public Health Service Colorado River Basin Water Quality Control Project Denver, Colorado
Eugene L. Peck	U. S. Weather Bureau Salt Lake City, Utah
James L. Pedersen	Public Health Service Colorado River Project Laboratory Salt Lake City, Utah
Charles H. Petersen	Public Health Service Colorado River Basin Water Quality Control Project Denver, Colorado
Albert L. Platz	Public Health Service Window Rock, Arizona
R. E. Polenske	Arizona Water Company Phoenix, Arizona
Robert B. Porter	Utah Power and Light Company Salt Lake City, Utah
James M. Quigley	U. S. Department of Health, Education, and Welfare Washington, D. C.

Travis H. Redman	Texas-Zinc Minerals Corporation Grand Junction, Colorado
Jack W. Rodner	Bureau of Reclamation, USDI Boulder City, Nevada
D. E. Rushing	Public Health Service Colorado River Project Laboratory Salt Lake City, Utah
Kirk M. Sandals	U.S. Department of Agriculture Berkeley, California
Arthur Schoen	U.S. Atomic Energy Commission Washington, D. C.
S. D. Shearer	Public Health Service Robert A. Taft Sanitary Engineering Center Cincinnati, Ohio
Frank G. Shelley	Utah State Farm Bureau Salt Lake City, Utah
William F. Sigler	Utah Water Pollution Control Board Logan, Utah
Carl B. Smith	Economic Research Service, USDA Salt Lake City, Utah
Sidney J. Spiegel	Public Health Service Colorado River Project Denver, Colorado
Charles E. Sponagle	Public Health Service Colorado River Project Denver, Colorado
Lyman S. Stanton	Western Phosphates, Inc. Salt Lake City, Utah
Murray Stein	Public Health Service Washington, D. C.
Clyde E. Stewart	Economic Research Service, USDA Logan, Utah
Edmund J. Struzeski, Jr.	Public Health Service Colorado River Project Denver, Colorado
Calvin K. Sudweeks	Utah State Department of Health Salt Lake City, Utah

Jerome H. Svore	Public Health Service, Region VII Dallas, Texas
N. A. Talvitie	Public Health Service Colorado River Project Laboratory Salt Lake City, Utah
Kenneth E. Tame	Bureau of Mines, USDI Salt Lake City, Utah
Irving M. Terzich	Public Health Service San Francisco, California
Lynn M. Thatcher	Utah Water Pollution Control Board Salt Lake City, Utah
J. D. Torrey	Public Health Service Denver, Colorado
Ernest C. Tsivoglou	Public Health Service Robert A. Taft Sanitary Engineering Center Cincinnati, Ohio
E. C. Van Blarcom	U.S. Atomic Energy Commission Washington, D. C.
C. E. Veirs	Bureau of Reclamation, USDI Salt Lake City, Utah
Lynn W. Wilkes	Economic Research Service, USDA Salt Lake City, Utah
Arthur E. Williamson	Wyoming Department of Public Health Cheyenne, Wyoming
Guy O. Woodward	Utah State University Logan, Utah
Theodore Woodward	Public Health Service Colorado River Project Laboratory Salt Lake City, Utah

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